NUCLEAR SCIENCE ABSTRACTS

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BIOLOGY AND MEDICINE

12959 UCLA-143
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1951. July 2, 1951. Decl. Mar. 6, 1957. 96p. Contract AT-04-1-GEN-12. $15.30(ph OTS); $5.40(mf OTS).

12960 UCLA-206
California. Univ. Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1952. July 10, 1952. Decl. Mar. 19, 1957. 80p. Contract AT-04-1-GEN-12. $12.30(ph OTS); $4.50 (mf OTS).

12961 UCLA-267
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1953. Oct. 1, 1953. Decl. Mar. 6, 1957. 88p. Contract AT-04-1-GEN-12. $13.80(ph OTS); $4.80 (mf OTS).

RADIATION HAZARDS AND PROTECTION

12962 LWS-29061
California Research and Development Co., Livermore Research Lab., Livermore, Calif.
ACCOUNTABILITY, SECURITY, AND HEALTH PHYSICS PROCEDURES FOR U^{235} IN EXPONENTIAL STUDIES. Apr. 21, 1953. Decl. Feb. 27, 1957. 18p. Contract AT(11-1)-74. $3.30(ph OTS); $2.40(mf OTS).

The description and quantities of U^{235} needed for the water boiler neutron source and the fission plate are stated. Accountability, security, and health physics procedures to be applied during receipt, storage, and use of the metal are presented. (B.J.H.)

CHEMISTRY

12963 ANL-4288(Rev.)
Argonne National Lab., Lemont, Ill.
CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT [FOR] OCTOBER, NOVEMBER, AND DECEMBER 1948. July 28, 1949. Decl. Mar. 18, 1957. 63p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

Progress is reported in studies on the following: reactions of Be with steam; effects of irradiation on beryllia and beryllia-uranium oxide materials; the physical properties of graphite; effects of pile irradiation on the physical properties of graphite; nuclear properties of graphite; the distribution of Wignerized atoms in graphite; an investigation of color centers in alkali halide crystals; radioinduced corrosion of Co and Ni; the absorption cross sections for fission products; identification of the 12-min activity induced by neutron irradiation of Nd; the design and counting efficiency of scintillation detectors; and measurement of the half-life of K^{40}. Brief observations are included on analytical procedures and special problems. (C.H.)

12964 BMI-263
Battelle Memorial Inst., Columbus, Ohio.
PURIFICATION OF THORIUM NITRATE BY SOLVENT EXTRACTION WITH TRIBUTYL PHOSPHATE. II. MIXER-SETTLER PILOT PLANT INVESTIGATIONS. Final Report. C. A. Burkart, D. D. Foley, F. A. Retzke, R. B. Filbert, Jr., and J. W. Clegg. July 31, 1952. Decl. Feb. 14, 1957. 63p. Contract AT-30-1-gen-288. $0.50(OTS).

The construction and operation of a mixer-settler pilot plant for the purification of mantle-grade $Th(NO_3)_4$ is described. The liquid-liquid extraction process utilized 30% TBP–70% "Solvesso-100" as the organic solvent and HNO_3 as the salting agent. Continuous steady-state operation of the equipment was demonstrated, with very good recovery of Th. The purified $Th(NO_3)_4$ product substantially met AEC specifications. (auth)

12965 CF-56-9-127
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT FOR SEPTEMBER 1956. W. K. Eister, J. C. Bresee, J. T. Long, E. O. Nurmi, and C. D. Watson. Decl. Mar. 21, 1957. 80p. Contract W-7405-eng-26. $0.55(OTS).

Development studies are reported in Excer Process, Fluorox Process, homogeneous reactor fuel and blanket processing, Metallex Process, U ore processing, and power reactor fuel reprocessing. (T.R.H.)

12966 CF-56-10-126(Del.)
Oak Ridge National Lab., Tenn.
STATUS REPORT FOR CHEMICAL DEVELOPMENT SECTIONS A AND B [FOR] WEEK ENDING OCTOBER 12, 1956. R. E. Blanco and D. E. Ferguson. Oct. 19, 1956. Decl. with deletions Mar. 13, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported on studies related to the processing of the fuel and blanket for the Homogeneous Reactor Test. Data are included from studies on the dissolution rate of Zr in H_2SO_4; radiation effects on samples of dry Amsco 125-82 and Thorex Process solvent; an analysis of UF_4 produced by the Excer Process from Vitro solvent extraction concentrate; and the precipitation of UO_4 from UO_2SO_4 solutions. (C.H.)

12967 HW-32417
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
STUDIES OF THE SYSTEM: THORIUM NITRATE, NITRIC ACID, WATER, TRIBUTYL PHOSPHATE, AND AMSCO 125-90W. W. W. Schulz and E. E. Voiland. Dec. 17, 1954. Decl. Apr. 1, 1957. 24p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

In the systems $Th(NO_3)_4-H_2O-TBP-Amsco$ 125-90W and $Th(NO_3)_4-HNO_3-H_2O-TBP-Amsco$ 125-90W two organic phases may form under certain conditions. The relationships between extracted Th and extracted HNO_3 at the phase transformation point are determined. The phase diagram for the system $Th(NO_3)_4-TBP-Amsco$ at 26.5°C is depicted as well as partial phase diagrams for the system $Th(NO_3)_4-H_2O-TBP-Amsco$. Distribution coefficients at the phase transformation point are also presented so that phase behavior may be predicted from initial conditions. The apparent

molar volume of $Th(NO_3)_4$ in TBP diluted with Amsco was found to be about 110 ml. TBP to Th ratios were determined for the organic systems at the phase transformation point. Ratios as low as 2.8 were observed. It was found that increasing temperature and/or TBP content lowers the TBP to Th ratio permissible in the organic phase without phase separation. No phase separation was observed with CCl_4 as the diluent. The phase separation is believed due to the 'salting out' effect of $Th(NO_3)_4 \cdot \times$ TBP on the diluent. The diluents, Shell Spray Base, Bayol D, and Ultrasene were found to be equivalent to Amsco in the tendency to form three phases when used in the system: $Th(NO_3)_4-HNO_3-H_2O-$TBP hydrocarbon diluent. (auth)

12968 IDO-16257

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

IN-PILE MOLTEN METAL–WATER REACTION EXPERIMENTS. O. J. Elgert and A. W. Brown. June 30, 1956. Decl. Mar. 18, 1957. 67p. Contract AT(10-1)-205. $10.80(ph OTS); $3.90(mf OTS).

Molten metal-water reaction tests have been conducted in the Materials Testing Reactor, in which the explosive reactions of aluminum, and zirconium have been investigated. The program was initiated as a part of the Boiling Heat Transfer Experiment to determine the safety aspects of extending heat fluxes to a point where the plates would melt. Two types of tests were made: Tests with the sample submerged in water during the entire run and tests where the sample would drop into the water after melting. Test samples, containing sufficient U^{235} to cause melting, were placed in autoclaves with water. The autoclaves were then irradiated from six to eighteen seconds in the high flux region of reactor positions A-31 or L-42. The autoclave pressure and sample temperature were recorded continuously during each run. After irradiation the volume of gas in the autoclave was measured and the gas analyzed. Some of the samples were then examined metallographically and others analyzed by X-ray-diffraction. A chemical reaction took place in all tests as indicated by the formation of hydrogen gas. The appearance of transients on the pressure versus time traces was taken as indications of violent reactions. No transients were observed during the runs where the sample did not melt. Seven of ten submerged aluminum samples melted. Transients up to 8,000 psi and 23,000 psi were obtained during two of the runs where the sample temperature remained around 1400°F. No transients were observed during other aluminum runs where the sample temperature went above 2200°F. Nine Nichrome V samples were run, seven of which melted. Transients were obtained during three of the runs with magnitudes up to 18,000 psi, 3,000 psi, and 1,000 psi, respectively. Six of seven zirconium samples melted with one of the melted samples producing transients up to 10,000 psi. In the three drop test runs, very little of the samples fell free and dropped into the water. Transients were recorded during one run only. This was the Nichrome V run where transients up to 3,000 psi were observed. It can be concluded from the results of these tests, that all the fuel plates tested can be made to react violently. However, no environmental conditions were found which would consistently result in a violent reaction. The violent reactions did not consume large portions of the sample or appear to have an effect on the per cent completion of the reaction although many sporadic pressure transients occurred. There is some indication with the aluminum samples that the probability of violent reaction is diminished at high rates of heating and at the high temperatures thereby reached. (auth)

12969 NYO-5147

Mallinckrodt Chemical Works, St. Louis.

THE REMOVAL OF "VITAMIN" (BORON) AND $SO_4^{=}$ FROM SODA SALT. A. L Grunewald. Dec. 4, 1945. Decl. Mar. 1, 1957. 9p. Contract W-7405-eng-1. $0.25(OTS).

Results revealed that B and SO_4^{2-} could be removed from impure sodium diuranate by digestion in a $NaHCO_3$ solution and then precipitating the sodium diuranate from this solution by the addition of NaOH. (W.L.H.)

12970 ORNL-1053

Oak Ridge National Lab., Tenn.

CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1951. Oct. 5, 1951. Decl. Mar. 19, 1957. 149p. Contract W-7405-eng-26. $22.80(ph OTS); $7.20(mf OTS).

Progress is reported in the following studies: the aqueous-benzene-TTA extraction method; electrocentrifuge studies of inorganic systems; electromigration on filter paper; vapor pressure-temperature relations of aqueous solutions of uranyl salts; the uranyl nitrate-water system above 180°C; the $UO_2SO_4-UO_3-H_2O$ system; the solubility of fission product sulfates; corrosion studies with synthetic HRE solutions; electrochemical corrosion studies; radionuclides of Sn, Tc, and Nb; fission product decay schemes; photoneutrons from energetic γ rays emitted by fission product radionuclides; the use of hydrogen peroxide in treating uranium metal dissolver off-gases; hot-atom chemistry in the solid state; measurements of magnetic susceptibilities of Tc; the synthesis of high-molecular-weight compounds containing C^{14}; the preparation of aromatic polynuclear compounds; the chemistry of separation processes; studies on Br, I, and Cl; the colorimetry of radioactivity; studies on solids and high temperature chemistry of Hf, Zr, and carbonate and potassium apatites; the radiation chemistry of alkali halides, heterogeneous catalysts, water and aqueous solutions, aqueous organic solutions, and HRE components; and developmental studies on 4π proportional β counters and precision pulse circuits (C.H.)

12971 TID-10161

New Brunswick Lab., AEC, N. J.

QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JUNE 30, 1951. C. J. Rodden. Dec 21, 1951. Decl. Mar 13, 1957. 233p. $1.35(OTS).

Chemistry of Feed Materials. Research is reported on equilibria in the $UO_2(NO_3)_2-HNO_3-$TBP–Kerosene system, properties of TBP, determination of TBP, scale deposition in TBP–U–kerosene extraction columns, preparation of UF_4 from UF_6, insolubility of UF_4 in HF, extraction of Th from monazite, extraction of Mo from pitchblende, and reactivity of lime at 1500 to 3000°C. Metallurgical Investigations. The rolling of U rods was investigated, and metallographic examination of rolled-U rods for grain size and preferred orientation is reported. Radiochemistry Investigations. An inexpensive β spectrometer and improvements in "shotgun" analysis equipment are described. Chemical Analysis. Detailed procedures are given for the following analyses: Ni in UF_4 by colorimetry; C in U metal by back titration of CO_2 taken up in standard $Ba(OH)_2$; x-ray absorption determination of BeO in Be powder; and rare earths in U by ether extraction of U and spectrographic examination of rare-earths concentrated by oxalate precipitation. An automatic recording thermobalance, a polarographic cell, and the use of a high-pressure ionization chamber to determine Ra in Congo ores are described. Spectrochemical Analysis. Methods are given for the determination of Al, Si, and Ca in pitchblendes, Al and Ca in Mg–U slurries, and impurities in CaO. (T.R.H.)

ANALYTICAL PROCEDURES

12972 NYO-5101
Mallinckrodt Chemical Works, St. Louis.
EFFECTS OF IMPURITIES ON THE EXCESS ACID TEST [IN URANIUM REFINERY FEED LIQUORS]. R. W. Bragdon. Mar. 27, 1945. Decl. Mar. 8, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

The effects of impurities Fe^{3+}, Ca^{2+}, Na^{+}, PO^{3-}, NO_3^-, and ether on the excess HNO_3 analysis of samples from the continuous ether extractor was investigated. (W.L.H.)

12973 ORNL-1973
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING OCTOBER 20, 1955. H. P. Raaen, ed. Oct. 28, 1955. Decl. Mar. 1, 1957. 57p. Contract W-7405-eng-26. $0.40(OTS).

Methods for the determination of Al and Fe in homogeneous reactor fuels, and Mo in UO_2SO_4 solutions were developed. Instrument development for intense radiation levels was continued. The neutron activation cross section of Ba^{130} was determined. A radiometric technique was developed for Pu analysis. Neutron activation analysis has been applied to the determination of the following: Au, and Cu in petroleum; Br_2 in sea water; Fe in Zr and Hf; Co; and S. Electron microscopy and particle-size studies of ThO_2 are discussed. The liquid-liquid extraction of Ce^{4+} with TTA was investigated. The effect of rare-earth impurities on the spectrographic determination of Sm, Dy, and Gd was determined. Additional methods were developed for the determination of SnO_2^{2-}, Hg, SiO_2, Fe, Rb, Mg, Ca, NO_3^-, Sr, and N_2. (C.W.H.)

12974 ORNL-1986
Oak Ridge National Lab., Tenn.
DETERMINATION OF TRIVALENT URANIUM WITH METHYLENE BLUE. W. J. Ross, A. S. Meyer, Jr., and J. C. White. Nov. 22, 1955. Decl. Feb. 20, 1957. 37p. Contract W-7405-eng-26.

A direct titrimetric method for the determination of U^{3+} in UF_3 and mixtures of fused fluoride salts was developed. The method is based on the stoichiometric oxidation of U^{3+} to the tetravalent oxidation state with an acidic solution of methylene blue. The sample containing U^{3+} is dissolved at room temperature in an excess of standard methylene blue solution in a CO_2 atmosphere; the excess oxidant is determined by titration with standard $CrSO_4$. The coefficient of variation of the method is 1.5% for 5 mg quantities of U^{3+}. The method was applied to various mixtures of fluoride salts containing both U^{3+} and U^{4+}. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

12975 NAA-SR-135
North American Aviation, Inc., Downey, Calif.
THE APPLICATION OF X-RAY LINE-SHAPE THEORY TO THE STUDY OF RADIATION DAMAGE. E. P. Cooper. July 3, 1951. Decl. Apr. 10, 1957. 41p. Contract AT-11-1-GEN-8. $0.40(OTS).

The success of the application of x-ray line-shape theory to the study of cold-work led to an examination of the possibilities of applying the same type of theory to the study of radiation damage. The cold-work theory is reviewed and its restrictions are pointed out. The possible differences between cold-work and radiation damage, as may be evidenced in the x-ray lines, are emphasized. Several simple models of distorted crystals are considered from the point of view of their x-ray diffraction to acquire insight into the nature of radiation-damaged crystal structure. The microstress type of distortion which is evidently characteristic of cold-work damage is not ruled out, but another type seems more plausible. In this the individual crystals, such as in a powder sample, are assumed to be uniformly damaged with the amount of damage varying slightly from crystal to crystal. (auth)

FLUORINE AND FLUORINE COMPOUNDS

12976 CF-54-2-114
Oak Ridge National Lab., Tenn.
HEAT CAPACITY OF FUEL COMPOSITION NO. 31. W. D. Powers and G. C. Blalock. Feb. 17, 1954. Decl. Aug. 14, 1957. 2p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

12977 CF-55-8-8
Oak Ridge National Lab., Tenn.
HEAT CAPACITY OF COMPOSITION NO. 102. W. D. Powers and G. C. Blalock. Aug. 1, 1955. Decl. Feb. 20, 1957. 2p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

12978 CF-56-5-66
Oak Ridge National Lab., Tenn.
HEAT CAPACITIES OF SEVERAL SODIUM FLUORIDE, ZIRCONIUM FLUORIDE COMPOSITIONS. W. D. Powers and G. C. Blalock. May 14, 1956. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

GRAPHITE

12979 KAPL-938
Massachusetts Inst. of Tech., Cambridge.
X-RAY MEASUREMENT OF RADIATION DAMAGE IN GRAPHITE. B. E. Warren and D. R. Chipman. July 7, 1953. Decl. Feb. 25, 1957. 21p. For Knolls Atomic Power Lab. Contract W-31-109-Eng-52, Subcontract AT (30-3)-49. $0.25(OTS).

The shape of a 001 reflection from damaged graphite can be described as a sharp pip sitting on a broad asymmetric peak. The effect is more like that of temperature vibration in a crystal than that of cold work in a metal. A simplified model is set up which involves two parameters α and ϵ where α is the probability that an occasional layer spacing is increased by the amount ϵ. For a sample with a low degree of irradiation $\epsilon = 0.94A$ and $\alpha = 0.097$. There is some evidence that the interstitial groups tend to position themselves with some degree of regularity so as to avoid being close neighbors of one another. (auth)

12980 NAA-SR-15
North American Aviation, Inc., Los Angeles.
EXPERIMENTAL TECHNIQUES IN ANNEALING BOMBARDED GRAPHITE. W. E. Parkins. Oct. 15, 1948. Decl. Apr. 10, 1957. 27p. Contract AT-11-1-GEN-8. $4.80(ph OTS); $2.70(mf OTS).

A method has been developed for annealing irradiated graphite by application of short-time temperature pulses. The graphite specimens used were first bombarded by the 60-in. cyclotron at Berkeley. Annealing data was obtained up to 2400°C, where graphite evaporation becomes appreciable. The results indicate three groups of activation energies, corresponding to maximum rates of annealing at approximately 300, 1200, and 1700°C. Progress of the annealing was followed by electrical resistivity measurements. Annealing decreases the resistivity in the region around 300° and 1700°C, but increases the resistivity in the 1200°C region. The bombarded graphite appears to be completely restored to normal when annealed at 2000°C. (auth)

12981 NAA-SR-28(Del.)
North American Aviation, Inc., Los Angeles.
LECTURE ON RELAXATION EFFECTS IN IRRADIATED GRAPHITE. F. W. Brown. Feb. 22, 1949. Decl. with deletions Feb. 29, 1957. 30p. Contract AT-11-1-gen-8. $6.30(ph OTS); $3.00(mf OTS).

12982 NAA-SR-232
North American Aviation, Inc., Downey, Calif.
PRELIMINARY EXPERIMENTS ON FISSION PRODUCT DIFFUSION FROM URANIUM-IMPREGNATED GRAPHITE IN THE RANGE 1800°–2200°C. C. T. Young and C. A. Smith. Mar. 25, 1953. Decl. Apr. 3, 1957. 27p. Contract AT-11-1-GEN-8. $0.30(OTS).

The diffusion of total fission product activity and separated Ba, Sr and Zr activities, from uranium-impregnated graphite which had been exposed in the Los Alamos Fast Reactor, was investigated at temperatures from 1880° to 2200°C. At 1880°C, more than 99% of the Ba and Sr activities diffused out of the graphite within 20 min of heating; at 2100°C, more than 99% diffused within 5 min. Only 2% of the Zr activity diffused out of the graphite after 4 hr at 2200°C. The differences in diffusion rates between Zr and the other two elements are in accord with known volatilities of their carbides. Approximately 85% of the total fission product activity diffused out after 4 hr at 2200°C, compared with 60% after the same time at 1880°C. These findings may be considered indicative, in a qualitative way, of the extent of decontamination by diffusion in homogeneous graphite fuel pellets of the size of the present samples, operating at high temperatures. Desirable extensions of the investigation to include observations on other separated activities, and on the effects of varying experimental conditions, are briefly discussed. (auth)

RADIATION EFFECTS

12983 HW-33164
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EXAMINATION OF SEVERAL DIFFERENT RUBBER COMPOUNDS AFTER EXPOSURE TO PILE WATER. W. S. Kelly. Sept. 24, 1954. Decl. Mar. 28, 1957. 7p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The effects of pile-water exposure on the tensile properties of several rubber compounds were investigated. Those rubbers showing the least change in ultimate strength were Huntington Buna N and #40230 6RS while Neoprene, #62507, and Huntington 408 Natural Rubber deteriorated to such a condition that they could not be tested. (C.W.H.)

12984 TID-5074(Del.)
California Research Corp., Richmond, Calif.
THE EFFECTS OF FISSION RADIATIONS ON LUBRICANTS AND LUBRICATION. PART III. STATIC IRRADIATIONS. R. O. Bolt, J. G. Carroll, and G. H. Denison. Feb. 15, 1952. Decl. with deletions Feb. 8, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

A series of organic compounds, with and without additives, was subjected to reactor radiation and gamma radiation in a search for stable lubricants. The materials tested are amylbipheny, didecyl tetephthalate, silicones, ethers, alkylnaphthalenes, mineral oils, polypropene oxides, alkylbenzenes, and di (2-ethylhexyl) sebacate. The changes in physical properties and the effects of various additives are tabulated. (T.R.H.)

12985 TID-5094(Del.)
California Research Corp., Richmond, Calif.
RESEARCH ON THE RADIATION STABILITY OF ORGANIC FLUIDS. Summary Report [for] April 30, 1951–May 30, 1952. July 1, 1952. Decl. with deletions Feb. 8, 1957. 44p. Contract AT(11-1)-174. $7.80(ph OTS); $3.30(mf OTS).

Investigations of the radiation stability of organic compounds which could be used as reactor coolants, lubricants, shield materials, and power transmission fluids are reported. A large number of compounds including ethers, esters, alkylbenzenes, alkylnaphthalenes, polypropene oxides, silicones, and alkyl biphenyls were irradiated at ORNL and Brookhaven under various conditions of atmosphere, temperature, flux, pressure, and with and without such additives as didodecyl selenide, iodobenzene, quinizarin, 1-methylnaphthalene, and polylauryl methacrylate. (T.R.H.)

SEPARATION PROCEDURES

12986 BMI-262
Battelle Memorial Inst., Columbus, Ohio.
PURIFICATION OF THORIUM NITRATE BY SOLVENT EXTRACTION WITH TRIBUTYL PHOSPHATE. Final Report. R. A. Ewing, J. B. Fishel, S. J. Kiehl, Jr., R. E. Sharpe, and A. E. Bearse. July 31, 1952. Decl. Feb. 14, 1957. 90p. Contract AT-(30-1)-gen-228. $0.60(OTS).

Purification of mantle-grade thorium nitrate by solvent extraction with 30% tributyl phosphate–70% Solvesso 100 was intensively investigated on a laboratory scale. Nitric acid was found to be a satisfactory salting agent. Batch equilibrium data are presented, covering the effects on thorium distribution of thorium concentration, TBP concentration, acidity, temperature, type of diluent, and the presence of sulfate and phosphate. Batch equilibrium data are also included on the intereffects of thorium and uranium. Solubility, viscosity, and density data are given for aqueous and organic solutions of thorium nitrate. The results of seven batch countercurrent extraction tests and two selective stripping tests are presented. Rare-earth assays of thorium products are included. (auth)

12987 BNL-78
Brookhaven National Lab., Upton, N. Y.
UNIT FOR CONTINUOUS SEPARATION OF U^{233} FROM THORIUM FLUORIDE. O. E. Dwyer. Sept. 15, 1950. Decl. Feb. 13, 1957. 29p. $0.30(OTS).

A preliminary design of a continuous experimental unit for producing U^{233} from Th^{232}, has been developed. This unit, when constructed, will be installed and operated in the Brookhaven reactor. The product is removed continuously from the Th by a stream of He gas containing F_2. The U is trapped out, and the carrier gas is reheated and returned to the furnace to repeat the cycle. (T.R.H.)

12988 CF-51-4-155
Oak Ridge National Lab., Tenn.
URANIUM ORES RECOVERY PULSE COLUMN TESTS. A. C. Jealous. Apr. 26, 1951. Decl. Feb. 15, 1957. 11p. Contract W-7405-eng-26. $0.25(OTS).

Pulse column tests of the scrub and strip operations of the Slurrex Process indicated that this type of contactor is operable at total flow rates of greater than 1200 gal/ft^2/hr. Operation at elevated temperatures (~50°C) increased the separation of Mo from U in scrubbing by a factor of 3, and decreased the U strip loss. The flooding rate of the strip column was increased by 30% by operation with a continuous organic phase. (auth)

12989 CF-52-5-144
Oak Ridge National Lab., Tenn.
ISOLATION OF U-233 FROM IRRADIATED SLUGS USING TBP AS THE EXTRACTANT. Quarterly Report For Period February 10 – May 10, 1952. C. V. Ellison. May

16, 1952. Decl. Apr. 2, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Seven complete U^{233} isolation runs have been made using the Cell-4 solvent extraction unit which consists of a dissolver and two ½-in. pulse columns. Four LITR and three Hanford irradiated slugs have been dissolved in 0.1M HF–60% HNO_3 mix, and the U^{233} isolated by extracting with 1.5% TBP in Amsco. Runs #1, #2, and #3 were made with a 24-in. scrub section on the extraction column and adequate separation of the U^{233} from Pa^{233}, Th and Al was not obtained. Lengthening the scrub section to 42 in. reduced the beta activity of the product to background and increased the Th decontamination from 5×10^2 to 3×10^4. An entrainment separator, installed between the extraction and strip column, eliminated any carry-over of aqueous with the organic, thus eliminating the carry of Al. (auth)

12990 CF-52-10-26

Oak Ridge National Lab., Tenn.

$Ca(OH)_2$ CONTACTORS FOR THOREX SOLVENT RECOVERY SYSTEM. W. R. Winsbro. Oct. 3, 1952. Decl. Apr. 2, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

12991 CF-55-5-34(Del.)

Oak Ridge National Lab., Tenn.

25 PROCESS ASSISTANCE FOR PERIOD OF APRIL 18, 1955 TO APRIL 29, 1955. F. L. Culler. May 5, 1955. Decl. with deletions Feb. 14, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Results are summarized from studies related to the development of the 25 Process and the Metallex Process. Data are included on the thermal decomposition of thorium nitrate and the chlorination of thorium oxalate using Cl_2 and CCl_4. (C.H.)

12992 CF-55-9-173

Oak Ridge National Lab., Tenn.

A HIGH-TEMPERATURE METALLEX STUDY. R. C. Reid. Sept. 9, 1955. Decl. Apr. 4, 1957. 41p. Contract [W-7405-eng-26]. $0.40(OTS).

The vapor phase, high-temperature Na reduction of $Th(Cl)_4$ was investigated and the results are presented. Mercury vapor acting as a carrier for sublimed $Th(Cl)_4$ was contacted with Na vapor, diluted with He. The products when cooled were noted to consist of nearly equal amounts of a solid powder phase and a phase which appeared to be clean Hg. Thorium, Na and chloride were found predominantly in the powder phase. Both phases were washed with 3N HCl and water. Thorium was distributed (a) as a filterable quasi in the Hg phase, (b) as dissolved Th in the acid wash, and (c) as a powder which was not wettable with mercury nor soluble in HCl. Analytical data indicate that a large fraction of the Th in the product was present as reduced metal. Corrosion of the equipment resulted in Fe, Ni, and Cr contamination of the product. The data also indicated that the vapor pressure of $ThCl_4$ in an impure feed salt was much lower than would have been anticipated from vapor pressure data of the pure salt. (auth)

12993 CF-56-2-154

Oak Ridge National Lab., Tenn.

CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT [FOR] FEBRUARY 1956. W. K. Eister. Decl. Apr. 2, 1957. 86p. Contract [W-7405-eng-26]. $0.60(OTS).

Chemical Engineering Research. A successful demonstration of hydraulic cyclones in liquid-liquid extraction is reported, and a steam pulser for solvent extraction columns was demonstrated. Excer. Electrolytic cell design and $UF_4 \cdot {}^3/_4H_2O$ filtering are reported. Fluorox. Production of UF_4 from Hanford screw-calcined UO_3, ore concentrate, and UO_2F_2 is described, and exploratory runs with the moving bed oxidizer are reported. HR Fuel Reprocessing. Results are given for loop studies of ZrO_2 and $Nd_2(SO_4)_3$ deposition, and testing and installation of equipment is described. Metallex. Optimum operating conditions for $ThCl_4$ reduction to ThHg were determined. Ore Processing. The installation and testing of a modified 12-in. slurry contactor is reported. Plutonium Producer Blanket Processing. The installation and testing of loops and loop equipment is reported. Power Reactor Fuel Reprocessing. Studies in dejacketing of Al-clad slugs are reported, and installation and/or testing of slug loaders, ion exchange contactors, and hydroclones is described. (T.R.H.)

12994 CF-56-9-84

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROGRAM—PROCESS TEST SECTION. H. M. McLeod, Jr. Sept. 19, 1956. 15p. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The status of the Raw Materials Process Testing Program is summarized and future work is discussed. A tentative schedule through FY 1959 of various phases of the work is given. The work schedule is planned on the assumption that the present manpower level will remain unchanged. (auth)

12995 CF-56-9-100

Oak Ridge National Lab., Tenn.

FEED MATERIALS PROCESSING STATUS REPORT FOR SEPTEMBER 1956. R. E. Blanco and W. K. Eister. Sept. 15, 1956. Decl. Feb. 20, 1957. 13p. Contract [W-7405-eng-26]. $0.25(OTS).

Hot filtration of Th quasi amalgam to remove reduction reaction by-products has not proved satisfactory. Less than 50% of the Th appeared in the filtrate. The quality of the sintered product was affected by the temperature differential between the metal sample and the furnace, by the holding temperature and pressure during retorting, and the holding time. Fluorox Process. The reduction-hydrofluorination moving-bed reactor was further modified. In the oxidation step, 3.5% C, added as graphite pellets, did not provide sufficient heat for the reaction. Excer Process. A new UF_4 preparation step is being studied in which UCl_4 is formed in the cell and UF_4 is precipitated in a separate step by adding HF. Ion-exchange Ore Processing. A 12-in.-diam Higgins continuous ion-exchange column has operated satisfactorily for 13 days with Dysart ore pulp at Grand Junction, Colo. (auth)

12996 CF-56-9-119

Oak Ridge National Lab., Tenn.

THOREX: SECOND THORIUM CYCLE MANPOWER AND COST SUMMARY. W. R. Winsbro and B. F. Bottenfield. Sept. 24, 1956. Decl. Mar. 13, 1957. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A second Th decontamination cycle, consisting of two solvent extraction pulse columns, a natural-convection evaporator stripper, and auxiliary mixing, storage, and surge vessels, was installed. Specifications, scheduling, and design and construction costs are reported. (L.T.W.)

12997 FMPC-435

National Lead Co. of Ohio, Cincinnati.

SOLVENT EXTRACTION OF THORIUM FROM BRAZILIAN SLUDGES. C. W. Taylor, A. M. Ross, and J. O. Davis. June 14, 1954. Decl. Apr. 1, 1957. 11p. Contract AT-(30-1)-1156. $0.25(OTS).

The feasibility of a solvent-extraction process for Th recovery from Brazilian concentrates (sludges) has been demonstrated on a pilot plant scale. (auth)

12998 HW-11885

Hanford Works, Richland, Wash.

NEUTRALIZATION OF HNO_3 IN REDOX ICU AND IAW STREAMS. M. H. Curtis. Dec. 10, 1948. Decl. Feb. 26, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Factors influencing choice of procedure used, hexone removal by evaporation in the presence of a retardant, destruction of retardant, HNO_3 elimination by boiling with Al, and concentration of the remaining solution by evaporation are reported. (J.E.D.)

12999 HW-13908(Del.)

Hanford Works, Richland, Wash.

THE SOLVENT-EXTRACTION PERFORMANCE OF REDOX IC COLUMNS (ANL JUNE 1948 FLOWSHEET) USING RASCHIG RING PACKING, AND UNIRRADIATED URANIUM. Redox Technical Study No. 14. Semi-Works Study Progress Report. L. O. Hartzell, F. W. Woodfield, and J. G. Bradley. Aug. 22, 1949. Decl. with deletions Feb. 23, 1957. 22p. Contract [W-31-109-Eng-52]. $4.80 (ph OTS); $2.70(mf OTS).

Data are reported for six IC column uranium runs using $\frac{1}{2}$-in. stainless steel Raschig rings in 4-in. and 5-in. diam. columns and four IC column uranium runs using $\frac{1}{4}$-in. stainless steel Raschig rings in an 8.42-in.-diam. column. These runs were made to study the mass transfer of natural (unirradiated) uranium in the absence of plutonium or fission products. Data from the flooding portion of one 5-in. column run are included. (L.T.W.)

13000 IDO-14204(Del.)

American Cyanamid Co. [Atomic Energy Div.], Idaho Falls, Idaho.

LABORATORY STUDIES OF THE PREPARATION AND USE OF DIBASIC ALUMINUM NITRATE FOR THE "25" PROCESS FEED ADJUSTMENT STEP. R. B. Lemon. Dec. 31, 1952. Decl. with deletions Feb. 27, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

Because of the possible advantages of the use of dibasic aluminum nitrate in the Idaho Chemical Processing Plant "25" Process feed adjustment step, studies of its preparation and use were undertaken. This report summarizes the work completed to date on this project. The preparation of dibasic aluminum nitrate using the method recommended by ORNL has been demonstrated on a laboratory scale. A solution approximately 7.5N acid deficient and 4.0M aluminum results from this procedure. When 2S aluminum is used for the preparation, the resulting solution must be filtered to remove the insolubles originally contained in the metal and also to remove metallic mercury which is present in the solution—a result of the reduction of the $Hg(NO_3)_2$ catalyst. It was found that medium or fine sintered glass filters precoated with filter aid have a capacity of approximately 500/ml/in.^{2} for this solution. Dissolver solutions adjusted to 0.2N acid deficiency with dibasic aluminum nitrate have essentially the same filtration characteristics as ammonium-hydroxide adjusted dissolver solution. As found by ORNL and also in this work, no local precipitation occurs when an aluminum nitrate-containing dissolver solution is adjusted to acid deficiency with dibasic aluminum nitrate solution. Possible advantages to the use of dibasic aluminum nitrate solution for the feed adjustment step are elimination of high ammonium nitrate concentrations in the first cycle feed and thus elimination of a possible explosion hazard from the first cycle raffinate evaporators and, as no precipitate is formed upon addition of dibasic aluminum nitrate solution to dissolver solution, the four-hour agitation time required after the adjustment step when ammonium hydroxide is used may be greatly reduced. The principal disadvantages to the use of dibasic aluminum nitrate for feed adjustment are an increase in first cycle aqueous waste volume and a decrease in first cycle capacities. Use of dibasic aluminum for adjusting a 1.0M HNO_3 dissolver solution decreases the capacity for NP and MTR processing 25% and increases the first cycle aqueous waste volume 41%. (auth)

13001 IDO-14243

American Cyanamid Co. Atomic Energy Div., Idaho Falls, Idaho.

PURIFICATION OF ENRICHED URANIUM PRODUCT FOR USE AS AN ANALYTICAL STANDARD. Investigation Order No. 144. G. K. Cederberg. May 1, 1953. Decl. Apr. 10, 1957. 7p. Contract AT(10-1)-177. $1.80(ph OTS); $1.80(mf OTS).

The purification of enriched uranium (about 90% U^{235}) by extracting with 30% TBP, stripping with H_2O, and precipitating as UO_4 is described. (C.W.H.)

13002 IDO-14376(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

INTEGRATED PILOT PLANT RUN. D. E. Griffin, G. E. Lohse, L. Chajson, and J. A. Buckham. June 10, 1955. Decl. with deletions Feb. 25, 1957. 32p. Contract AT(10-1)-205. (PPC-189(Del.)). $6.30(ph OTS); $3.00(mf OTS).

Pilot plants runs of the 25 Process were conducted for a duration of 114 hours. Generally, operations proceeded smoothly and the waste losses obtained were as good as, if not better than those expected. Two subsequent runs totalling 12.5 hours during which offstandard feed and heel cleanout feed were processed gave much lower waste losses than were expected. (W.L.H.)

13003 K-903

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

URANIUM EXTRACTION WITH TRIBUTYL PHOSPHATE IN A PULSE COLUMN. Karl Kniel, C. L. Gregory, E. R. Renier, and R. H. Reuther. Apr. 7, 1952. Decl. Feb. 23, 1957. 33p. For Carbide and Carbon Chemicals Div. Y-12 Plant. Contract W-7405-eng-26, Subcontract 70. $6.30(ph OTS); $3.00(mf OTS).

The effect of variation in TBP concentration in Varsol upon U extraction in a pulse column was studied. Values of $H.T.U._{OE}$ for an aqueous feed containing $UO_2(NO_3)_2$, HNO_3, and $NaNO_3$ were obtained for a constant volume ratio of pure TBP to aqueous flow rate. The value of $H.T.U._{OE}$ decreased with increasing values of % TBP. This is explained on the basis of a decrease in organic flow rate with increasing % TBP. HNO_3 was found to be extracted into the organic phase at the bottom of the column and to be stripped from the organic phase into the aqueous phase at the top of the column. Equilibrium and operating lines are presented for HNO_3 extraction. (D.E.B.)

13004 KAPL-213(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

RECOVERY OF ALUMINUM NITRATE FROM REDOX AQUEOUS WASTE STREAMS. J. A. Ayres, G. E. McCullough, W. F. McKeehan, and R. H. Simon. July 20, 1949. Decl. with deletions Feb. 28, 1957. 24p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The precipitation of $Al(NO_3)_3$ from Redox waste streams with HNO_3 was studied. Experiments in small scale glass apparatus and in a stainless steel pilot plant show that precipitation with 80 to 85% HNO_3 has several advantages, but the use of constant boiling HNO_3 (68 to 70%) is more attractive. (T.R.H.)

13005 KAPL-M-JKD-8

Knolls Atomic Power Lab., Schenectady, N. Y.

PROCESSING PLANT FOR THE KAPL FAST OXIDE BREEDER. J. K. Davidson. Mar. 7, 1955. Decl. Mar. 27, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A processing plant capable of decontaminating the spent fuel from the core of the KAPL Fast Oxide Breeder has been conceptually designed. The process is based on an adaption of the standard Purex solvent extraction flowsheet, and although no detailed data are available, it is felt reasonably certain that such a flowsheet can be made to work. Emphasis has been placed on the preliminary design of an inexpensive physical plant, and the concept of disposal rather than maintenance of the hot equipment is used to arrive at a plant design having a minimum of shielded volume. (auth)

13006 KLX-70

Kellex Corp., New York.

OPERATION OF UNDERWATER TEST BASIN. JOB 11. Detailed Project Status Report [Covering the Period January 21, 1949 to July 19, 1949]. 11p. With this is bound an Appendix—KLX-70-A. Sept. 30, 1949. Decl. Mar. 4, 1957. 139p. Contract AT-30-1-Gen-169. $22.80 (ph OTS); $7.20(mf OTS).

Engineering design of the Job 11 Metals Recovery Plant was based on installing and operating the principal process equipment in a series of water-filled basins. This design was developed as an alternate to the conventional cell-in-canyon type of arrangement of the existing Hanford separations plants. Mechanical problems such as the design of leak-proof process equipment and instruments; the development of suitable disconnect techniques and devices; and the development of suitable remote operation and maintenance tools and techniques were studied. Carried on concurrently was a study of methods of treating Jersey City water to make it satisfactory for use in the basin, a study of the use of color combinations as a means of improving the ease of handling underwater equipment, and an experimental study of the absorption of droplets of hexone by basin water. (G.Y.)

13007 KLX-1610

Vitro Corp. of America, New York.

HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT FOR FEBRUARY 1953. Job 57. Mar. 10, 1953. Decl. May 13, 1957. 11p. Contract AT(11-1)-217. $1.80 (ph OTS); $1.80(mf OTS).

In attempts to develop a better method of adsorbing fission-product poisons than the untreated fluorite method, studies were continued on the batch-scale removal of β-radioactive material from Purex wastes by adsorption on $Pb_3(PO_4)_2$, CaF_2, $LiAlO_2$, and PbO. (B.J.H.)

13008 KT-69

Massachusetts Inst. of Tech., Oak Ridge, Tenn.

Engineering Practice School.

THE DESIGN, CONSTRUCTION, AND OPERATION OF A PULSE COLUMN FOR THE PURIFICATION OF ZIRCONIUM. G. R. Jasny, P. M. Blair, H. C. Harrison, and G. R. Nelson. May 3, 1950. Decl. Mar. 4, 1957. 19p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70]. $3.30(ph OTS); $2.40(mf OTS).

The experimental pulse column constructed for this investigation appears satisfactory for Zr purification. Structurally, the column performed well, showing no plugging by solids and no leakage. Increasing the frequency and displacement of the pulse appears to increase column efficiency in the range of variables studied. On the other hand, increasing the total flow rate appears to decrease column efficiency. Under the conditions of Run 6, the most favorable run of this investigation, the height of the column is approximately equivalent to six mixer-settler stages. For the same run, an HETS of 2.5 ft ± 1.8 ft was calculated on the basis of Hf removal. It is concluded that a pulse column would reduce the height necessary to obtain the present product purity of 100 ppm of Hf by at least 80%, assuming a scale-up factor of unity. (auth)

13009 M-2934

[Du Pont de Nemours (E. I.) & Co.] Jackson Lab., Wilmington, Del.

TENTATIVE CHAMBERS WORKS PROCESS FOR THE MANUFACTURE OF C-112. (Second Revision). C. W. Maynard, Jr. Aug 19, 1944. Decl. Mar. 6, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

A tentative Chambers Works Process is described for the preparation of $UO_4 \cdot 2H_2O$ from dilute feeds. (W.L.H.)

13010 M-3002

[Du Pont de Nemours (E. I.) & Co.] Jackson Lab., Wilmington, Del.

TENTATIVE DYE WORKS PROCESS FOR THE MANUFACTURE OF C-112 FROM N. G. SOLUTIONS. C. W. Maynard, Jr. Sept. 23, 1943. Decl. Mar. 6, 1957. 5p. $1.80(ph OTS); $1.80(mf OTS).

A tentative dye works process is described for the recovery of $UO_4 \cdot 2H_2O$ from N.G. (no good) solutions. (W.L.H.)

13011 MCW-3

Mallinckrodt Chemical Works, St. Louis.

THE COPRECIPITATION OF BORON WITH SODIUM URANATE. A. E. Ruehle. Apr. 1, 1946. Decl. Feb. 26, 1957. 4p. Contract W-7405-eng-1. $0.20(OTS).

A preliminary removal of B from high B raw materials is necessary since the specification for B in purified U compounds is low, only small amounts can be tolerated in the feed to the extraction column. It was found that coprecipitation of B with Na_2UO_4 can be greatly reduced by precipitating from a $NaHCO_3$ solution and better filter rates can be obtained by precipitating first $CaCO_3$ than uranate and filtering them together. (J.E.D.)

13012 MCW-11

Mallinckrodt Chemical Works, St. Louis.

THE CONCENTRATION OF UX_1 FROM PURIFIED AND AGED URANIUM DIOXIDE. Harold Yeager. Apr. 1, 1946. Decl. Feb. 26, 1957. 6p. Contract W-7405-eng-1. $0.25 (OTS).

Purified and aged UO_2 was dissolved in HNO_3 and the uranyl nitrate was extracted with four successive portions of ether. After the fourth extraction the $UX_1(Th^{234})$ was precipitated with NaOH at a controlled pH. A 2 lb sample representing approximately 3000 lb of the original 7000 lb of UO_2 was obtained which had a UX_1 concentration greater than 1000 times the UX_1 concentration of the original UO_2. (auth)

13013 MCW-15

Mallinckrodt Chemical Works, St. Louis.

SEPARATION OF RADIUM FROM URANIUM BY COPRECIPITATION FROM NITRIC ACID SOLUTIONS OF PITCHBLENDE ORE. C. F. Ritchie. Apr. 1, 1946. Decl. Feb. 26, 1957. 17p. Contract W-14-108-Eng-8. $0.30 (OTS).

An extensive series of pilot-plant tests was conducted on the NHO_3 leaching of U from pitchblende ores, which contained an appreciable amount of HNO_3–insoluble, siliceous residue and important quantities of Ra. Separation of Ra from U in the leach solutions was accomplished by coprecipitation of the Ra with $PbSO_4$, with $BaSO_4$, or with both.

Controlling factors were the completeness of U extraction, the preparation of Ra; containing residues amenable to commercial processing on continuous rotary vacuum filters, and the use of minimum quantities of reagents. Six variations of the basic process were tested. The use of $BaSO_4$ as a coprecipitating agent was found to provide no advantage. Average Ra loss to the filtrates ranged from 0.20 to 0.56% for methods not utilizing $BaSO_4$ and from 0.78 – 100% for methods utilizing $BaSO_4$. Details of the basic process as recommended originally by Yale University research workers were improved considerably during the course of this pilot-plant program. The conclusion was that a commercial-scale process is feasible for complete recovery of U, with formation of a gangue-Pb-Ra coprecipitate containing an average of 99.5% of the original Ra. Occasional losses of Ra as high as 1.5% may be expected. (J.E.D.)

13014 MCW-20
Mallinckrodt Chemical Works, St. Louis.
THE SALTING-IN AND SUPERSATURATION OF BARIUM AND LEAD SULFATES IN URANYL NITRATE SOLUTIONS DERIVED FROM PITCHBLENDE. A. E. Ruehle. Apr. 1, 1946. Decl. Feb. 26, 1957. 7p. Contract W-7405-eng-1. $0.25(OTS).

The supersaturation of barium sulfate is less than 5% as great as the salting-in of barium sulfate by uranyl nitrate. Lead sulfate is salted-in very strongly by uranyl nitrate, its solubility in concentrated solutions being as much as 500 times its solubility in water. Ferric nitrate is much more effective than calcium nitrate in holding barium sulfate and/or lead sulfate in solution on extraction of the uranyl nitrate with the other. A boildown procedure is helpful in reducing the amount of barium sulfate dissolved in uranyl nitrate solutions. (auth)

13015 MITG-247(Del.)
Massachusetts Inst. of Tech., Watertown, Mass. Mineral Engineering Lab.
LYOMETALLURGY SURVEY. F. W. Bloecher, Jr. Jan. 25, 1951. Decl. with deletions Feb. 26, 1957. 33p. Contract AT-30-1-Gen-211. $6.30(ph OTS); $3.00(mf OTS).

The amenability of some U ores and U products to leaching with organic solvent containing HNO_3, pre-leach digestion with H_2SO_4, and pre-leach digestion with HNO_3 is discussed. Uranium extractions ranged from 0 to 90%, depending on material and treatment. (T.R.H.)

13016 NYO-5190
Mallinckrodt Chemical Works, St. Louis.
REMOVAL OF MOLYBDENUM IN PROCESSING AAA [PITCHBLENDE] ORE. VI. WASHING METHODS. A. S. Tomcufcik. July 1946. Decl. Mar. 8, 1957. 13p. Contract W-14-108-eng-8. $3.30(ph OTS); $2.40(mf OTS).

The removal of MoO_3 from ether–$UO_2(NO_3)_2$ solutions in the processing of AAA Ores is described. This study compares the salting efficiency of $Fe(NO_3)_3$ to $Ca(NO_3)_2$. Results show conclusively that $Fe(NO_3)_3$ is more efficient than $(Ca(NO_3)_2$. (W.L.H.)

13017 ORNL-323(Pt. II)
Oak Ridge National Lab., Tenn.
TECHNICAL DIVISION REPORT FOR QUARTER ENDING FEBRUARY 28, 1949. PART II. E. C. Miller, ed. Feb. 28, 1949. Decl. Mar. 8, 1957. 79p. Contract W-7405-eng-26. $13.80(ph OTS); $4.80(mf OTS).

Work was continued in the development of the Redox Process. A 50 gallon semi-works plant was designed to test the precipitation steps of the uranyl ammonium phosphate (UAP) Process. Radiochemical liquid waste disposal plans are being formed for extensive modification and improvement of the ORNL waste collection, treatment, and storage systems. (W.L.H.)

13018 ORNL-1242(Del.)
Oak Ridge National Lab., Tenn.
DECONTAMINATION OF ORNL PUREX PILOT PLANT. H. P. Wood. May 5, 1952. Decl. with deletions Mar. 1, 1957. 50p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

13019 ORNL-1610(Rev.)
Oak Ridge National Lab., Tenn.
LABORATORY DEVELOPMENT OF THE THOREX PROCESS. Progress Report [for] February 1, 1953 to July 31, 1953. A. T. Gresky, M. R. Bennett, S. S. Brandt, W. T. McDuffee, B. G. Ryle, J. E. Savolainen, and R. P. Wischow. Apr. 22, 1954. Decl. Mar. 25, 1957. 97p. Contract W-7405-eng-26. $0.60(OTS).

Laboratory-scale studies on the Thorex process have led to the recommendation that excess acid be removed from the organic stream in a slightly longer B-column with very dilute nitric acid rather than in a separate column with "acid-deficient" aluminum nitrate as formerly. A head-end evaporation-reflux treatment of the feed is recommended to prevent loss of thorium, to coagulate colloidal siliceous material and thus minimize emulsions in later steps, and to decrease the ruthenium in the product stream. Pa^{233} adsorption by silica gel was inhibited by niobium, ferric, or chromic ions. (auth)

13020 ORNL-2020
Oak Ridge National Lab., Tenn.
EFFECT OF PLANT SIZE ON COSTS OF PUREX PROCESSING OF HETEROGENEOUS POWER REACTOR FUEL. J. W. Ullmann. Feb. 1, 1956. Decl. Apr. 26, 1957. 15p. Contract W-7405-eng-26. $0.30(OTS).

Cost estimates are given for 1- to 16-ton/day privately owned Purex processing plants. A 4-ton/day plant is estimated to be required to achieve 1 mill/kwh chemical reprocessing costs with fuel irradiated to 2000 Mwd/ton. Such a plant would handle the fuel discharged from sixteen 500-Mw reactors. If the same reactors discharged fuel irradiated to 10,000 Mwd/ton, a chemical reprocessing cost of 0.3 to 0.4 mill/kwh is anticipated. As plant sizes increase, the cost of shipping irradiated fuel becomes a larger fraction of the total reprocessing cost. (auth)

13021 TID-5318
Hooker Electrochemical Co., Niagara Falls, N. Y.
PLANT PERFORMANCE OF AN ACTIVATED CARBON SYSTEM FOR THE RECOVERY OF BORON TRICHLORIDE. R. G. Gardella and E. A. Belmore. Apr. 25, 1956. Decl. Mar. 19, 1957. 24p. Contract AT(30-1)-1524. $4.80(ph OTS); $2.70(mf OTS).

The economy effected at the Boron Metal Plant through the use of activated carbon for BCl_3 and BF_3 recovery is discussed. The installation was simple and operation was economical. In one application, vent gases were recovered, replacing a liquid N_2 condensing system. The other application reduced N_2 costs and shortened and smoothed the operating cycle. (T.R.H.)

13022 TID-10174
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR ENGINEERING PROGRAM, 1947–1948. RADIOCHEMISTRY V. J. F. Flagg. Lecture Notes by L. Epstein. Apr. 29, 1948. Decl. Mar. 20, 1957. 19p. Contract W-31-109-Eng-52. $0.30(OTS).

Basic steps in the Redox Process for the separation of Pu and U are outlined. Extraction column operation for each step is discussed. The solvent properties of hexone are reviewed. (C.W.H.)

13023 UCRL-912(Del.)
California. Univ., Berkeley. Radiation Lab.
EVALUATION OF THE PENTAETHER AND CHELATE PROCESSES FOR THE CHEMICAL SEPARATION OF PLU-

TONIUM AND URANIUM. T. E. Hicks and H. W. Crandall. Sept. 18, 1950. Decl. with deletions Mar. 4, 1957. 20p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A summary of work done on the recovery and decontamination of U using pentaether, and recovery and decontamination of Pu using TTA is presented and a basic flowsheet proposed. (T.R.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

13024 CN-633

[Chicago. Univ. Metallurgical Lab.]

CHEMICAL RESEARCH — PRODUCTION AND EXTRACTION OF 94. Report for Period April 16–April 30, 1943. Decl. Feb. 14, 1957. 20p. (A-630). $4.80(ph OTS); $2.70(mf OTS).

The effect of Al in the extraction solutions of the wet fluoride process is described. Its interference with LaF_3 precipitation necessitates Al coating removal prior to dissolution. Dissolution of LaF_3 is now done with $Zr(NO_3)_4$. Studies of the use of silica gel and $Zr_3(PO_4)_4$ as adsorbents for Pu are described. The conditions for HNO_3 oxidation in the $BiPO_4$ process are revised. Development work for a fluoride volatility process is continued. (T.R.H.)

URANIUM AND URANIUM COMPOUNDS

13025 ANL-5349

Argonne National Lab., Lemont, Ill.

REFINING OF URANIUM BY MELTING AND LIQUATION. B. Blumenthal. Nov. 1955. Decl. Apr. 4, 1957. 95p. Contract W-31-109-eng-38. $0.60(OTS).

Reactor grade U, both biscuit metal and Hanford fuel slugs, was melted and liquated in a high vacuum in a variety of crucible materials. Resistance and induction heating were used. Liquation in urania crucibles removes N_2 and O_2 to very low limits (less than 10 ppm). Carbon is partially removed by this method. A variety of conditions and reactions was studied to effect a more complete carbon removal. The study comprised the use of MgO crucibles, melting in a H_2 atmosphere, UN, Ta, Ti, and Zr additions, and stirring with a Ta rod. These experiments had but a limited success with respect to carbon removal. Most of the reactions greatly affected the microstructure of U and, therefore, were evaluated metallographically as well as by chemical and spectrochemical analysis. The optimum melting conditions are stated by which the contamination of reactor grade U can be held within 130 to 200 ppm total impurities. An appendix describes a new process for the control of stringers in reactor grade U. (auth)

13026 CF-54-6-60

Oak Ridge National Lab., Tenn.

DENITRATION OF URANYL NITRATE HYDRATE. J. E. Moore. June 9, 1954. Decl. Apr. 2, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The possibility of using spray calciners and moving-bed shaft reactors for $UO_2(NO_3)_2$ denitration to produce UO_3 has been investigated. Both methods appear feasible, but further developmental work is necessary. (D.E.B.)

13027 H-6.350.25

Tennessee Eastman Corp., Oak Ridge, Tenn.

VAPOR PHASE CHLORINATION OF URANIUM OXIDES AND CORROSION STUDIES; PROGRESS REPORT – PROJECT 31. G. S. Parsons and C. E. Larson. Nov. 21, 1946. Decl. Feb. 25, 1957. 11p. Contract W-7405-eng-23. $3.30(ph OTS); $2.40(mf OTS).

Investigations were continued on the vapor phase chlorination of $UO_4 \cdot 2H_2O$ and the corrosion of stainless steel, Ta, Al alloys, and other metals by synthetic plant solutions, machine wash solutions, and nitric acid. (C.W.H.)

13028 HW-30451

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MAXIMUM TEMPERATURE IN THIN RECTANGULAR URANIUM WAFERS. C. R. McNutt. Jan. 6, 1954. Decl. Mar. 13, 1957. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A calculated value of the maximum U wafer temperature above local water temperature is 7.9°C for wafers under irradiation in the outer fringe zone. (F.S.)

13029 HW-35814

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRECIPITATION OF URANIUM AMMONIUM FLUORIDE FROM UNH SOLUTIONS AS AN INTERMEDIATE IN THE PREPARATION OF URANIUM TETRAFLUORIDE. W. B. Tolley. Feb. 1, 1955. Decl. Feb. 23, 1957. 11p. Contract W-31-109-Eng-52. $0.25(OTS).

Uranyl solutions can be reduced with ferrous ions in the presence of fluoride, precipitating a uranium (IV) fluoride. UF_4 prepared in this manner is difficult to filter and wash and generally is not suitable as an intermediate. Dehydration can only be accomplished in a HF atmosphere at elevated temperatures, thereby incorporating the difficulties experienced in the hydrofluorination process. However, $U(NO_3)_2$ solutions reduced in the presence of $(NH_4)_2F_2$ or NH_4F yield a double salt, $UF_4(NH_4F)$, fluoride, which exhibits excellent precipitate characteristics. This compound can be decomposed at 375°C to UF_4 and volatile NH_4F. The NH_4F is easily trapped and can be recycled for subsequent precipitations. UF_4 prepared by precipitation from $U(NO_3)_2$ solutions has been reduced in an hermetically sealed bomb by reaction with Ca. Reduction yields of approximately 80% were realized on a 20-gm. scale. During reduction the coprecipitated Fe is concentrated in the U. (auth)

13030 IDO-14048

American Cyanamid Co. Atomic Energy Div., Idaho Falls, Idaho.

PRELIMINARY REPORT ON THE USE OF THE CONSOLIDATED ENGINEERING CORPORATION MASS SPECTROMETER, MODEL 21-120, FOR THE ISOTOPIC ASSAY OF URANIUM. W. E. Duffy, K. M. Heaton, and R. J. Francel. Feb. 4, 1952. Decl. Feb. 25, 1957. 29p. Contract [AT-(10-1)-177]. $4.80(ph OTS); $2.70(mf OTS).

The Consolidated Engineering mass spectrometer, Model 21-120 is described and is compared to Model 21-103. The precision reported for the abundance of U^{235} in 36 assays, whose assay was known, is ± 0.01%. An experiment performed to determine the feasibility of using a thermal-emission type of source indicated that it was impossible to obtain adequate resolution by this approach. (F.S.)

13031 KLX-1210

Kellex Corp., New York.

EVALUATION OF SOLVENT LEACHING PROCESS FOR PITCHBLENDES. Jan. 5, 1951. Decl. Mar. 26, 1957. 15p. Contract AT(30-1)-848. $3.30(ph OTS); $2.40(mf OTS).

An evaluation was made of the solvent leaching process for U extraction from ores. The process was found to be completely practicable from a chemical viewpoint for pitchblendes, black oxide, and soda salt. Its practicability from a mechanical viewpoint was demonstrated for pitchblendes in pilot plant operation and it is expected that behavior of black oxide and soda salt will also be satisfactory. Extraction data and flowsheets are included. (C.H.)

13032 LA-1860
Los Alamos Scientific Lab., N. Mex.
EFFECTS OF CERTAIN VARIABLES UPON THE REACTIONS FOR PREPARATION, BY THE DRY METHOD, OF UF_4 FROM U_3O_8. R. W. Kewish and O. E. Fry. Nov. 4, 1954. Decl. May 2, 1957. 22p. Contract W-7405-eng-36. $0.30(OTS).

The effects of certain process variables on the production of UF_4 from U_3O_8 have been studied. It was found that the initial step (reduction of U_3O_8 to UO_2 by H_2) is complete in a few minutes at an elevated temperature. The rate of conversion was shown to be temperature dependent. An optimum temperature was determined for the conversion of UO_2 to UF_4 by HF. Changes resulting from the present study and yielding an increased efficiency in the production process are described. (auth)

13033 MCW-2
Mallinckrodt Chemical Works, St. Louis.
THE PREPARATION OF PURE URANYL NITRATE SOLUTION FROM IMPURE SODIUM DIURANATE. C. R. Conard. Apr. 1, 1946. Decl. Feb. 26, 1957. 18p. Contract W-7405-Eng-1. $0.30(OTS).

A process was devised for use of sodium salts (sodium diuranate) in the process and equipment designed for black oxide (U_3O_8). A similar process was worked out for the reprocessing of liquors containing high concentrations of impurities from both the black oxide and the sodium salts. (J.E.D.)

13034 MCW-7
Mallinckrodt Chemical Works, St. Louis.
REDUCTION OF URANIUM TRIOXIDE TO THE DIOXIDE WITH VARIOUS GASES. R. W. Shearer. Apr. 1, 1946. Decl. Feb. 26, 1957. 47p. Contract W-7405-eng-1. $0.45(OTS).

A study of five gases as reducing agents in the reduction of UO_3 to UO_2 indicated that general conditions for use included a high temperature (about 1500°F) and about a 100% excess of gas flowing over the trioxide in a properly designed furnace box. Cracked ammonia gas was the most economical, most readily available, and most easily usable of the gases considered. Hydrogen was efficient but more costly than cracked ammonia. Hydrogen gas saturated with water vapor could be used. Anhydrous ammonia gas was required in greater quantity than cracked ammonia. Artificial and natural gas reduced the UO_3, but heavy deposits of carbon were formed which might flake and contaminate the product. (J.E.D.)

13035 MCW-9
Mallinckrodt Chemical Works, St. Louis.
AN INVESTIGATION OF METHODS FOR THE RECOVERY OF URANIUM FROM RESIDUES OBTAINED DURING THE MANUFACTURE OF PURE URANIUM DIOXIDE. G. C. Reid. Apr. 1, 1946. Decl. Feb. 26, 1957. 18p. Contract W-7405-eng-1. $0.30(OTS).

Several methods for recovering U from residues, obtained during the manufacture of UO_2, were investigated. The most promising method, particularly from the standpoint of adaptability to almost any type of redisue, includes as the main step reduction of U to U_3O_8 with C at a high temperature, in the presence of Na ion which reacts with other elements present to form soluble Na salts. These salts can then be separated from the U by leaching and filtration. (auth)

13036 MCW-25
Mallinckrodt Chemical Works, St. Louis.
THE PREPARATION OF PURE URANIUM TETRAFLUORIDE BY A WET PROCESS. J. V. Opie. Apr. 1, 1946. Decl. Feb. 26 1957. 11p. Contract W-7405-Eng-29. $0.25(OTS).

Two methods were developed for the production of UF_4 by a wet process, both being accomplished in water phases and producing UF_4 as a precipitate. One method used UO_2 as a raw material and the other UO_3. The involved procedure required for each method, and the failure of the product to exceed the quality of that produced by the dry process, eliminate these methods as competitors of the dry process. (C.H.)

13037 MCW-138
Mallinckrodt Chemical Works, St. Louis.
FLUORINATION OF URANIUM DIOXIDE WITH HYDROGEN FLUORIDE–WATER MIXTURES. Carl W. Kuhlman, Jr. Sept. 27, 1948. Decl. Mar. 15, 1957. 21p. $4.80 (ph OTS); $2.70(mf OTS).

The reaction rates of the reaction $UO_2 + HF \rightarrow UF_4 + 2H_2O$ were measured at various temperatures using HF-H_2O mixtures of varying compositions. The fluorination rate was found to be a function of the available HF concentration of the gas (% HF present – % HF equil.) and temperature. Measurements are tabulated. (auth)

13038 MCW-1387
Mallinckrodt Chemical Works, St. Louis.
COMPENDIUM OF MALLINCKRODT REPORTS ON SLAG PROCESSING. N. E. Berry, ed. Feb. 29, 1956. Decl. Apr. 10, 1957. 308p. Contract W-14-108-eng-8. $1.60 (OTS).

Topics discussed include various methods for the recovery of U from MgF_2 bomb slag; the recovery of U and HF from MgF_2; determination of U in slag by means of x-ray fluorescence; the recovery of U from recycle slag; the startup and operation of a slag plant; laboratory investigations of carbonate leaching of reject slag for the recovery of U; ion exchange recovery of U from carbonate slag leach solutions; plant studies of slag liner production; and magnesium uranate studies in connection with slag leaching. (C.H.)

13039 MTA-42
California Research and Development Co. Livermore Research Lab., Livermore, Calif.
FISSION AND CAPTURE EVENTS IN 24 INCH × 24 INCH CROSS SECTION URANIUM TARGETS BOMBARDED WITH 190 MEV DEUTERONS AND 340 MEV PROTONS. H. G. Hicks, P. C. Stevenson, R. S. Gilbert, and W. H. Hutchin. Sept. 1953. Decl. Apr. 9, 1957. 14p. Contract AT(11-1)-74. $3.30(ph OTS); $2.40(mf OTS).

Fission and capture events were measured in unmoderated U targets (24 in. × 24 in. × 5.75 in. deep and 13 in. deep) bombarded with 190-Mev deuterons and 340-Mev protons. Results from the bombardments of these targets approximated those expected for targets of larger external dimensions. The presence of U^{235} has no effect on the neutron production. (auth)

13040 NYO-5054(Del.)
Mallinckrodt Chemical Works, St. Louis.
GRAPHITE LINER PROGRAM. Report No. 2. June 26, 1944. Decl. with deletions Feb. 26, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

A description is given of steel shells and graphite crucibles for U casting. The assembled crucible is placed centrally in the steel shell with 2 in. of dolomite above and below the graphite and $\frac{5}{8}$ in. around the sides. The bomb was loaded and fired. Four runs were made and results on the Fe and B content of two biscuits made from Amco 199 Mg are given. (J.E.D.)

13041 NYO-5056(Del.)
Mallinckrodt Chemical Works, St. Louis.
GRAPHITE LINER PROGRAM REPORT NO. 4. Aug. 14, 1944. Decl. with deletions Feb. 26, 1957. 19p. $3.30(ph OTS); $2.40(mf OTS).

Billets (4-in. diam. by 7.5 in.) and dogs (1.5-in. diam. by 10 in.) produced in various UF_4-reduction crucibles, in which the charge was supported above the graphite mold by a thin Mg plate, are illustrated. The number and arrangement of holes in the molds and the thickness of lime insulation was varied. Some of the dogs and billets were of high metal quality but had thick slag coatings and widely distributed tiny slag inclusions. (auth)

13042 WASH-298(Del.)
Division of Research, AEC.
URANIUM ALLOY NEWSLETTER. Edward Epremian, ed. Sept. 1956. Decl. with deletions Mar. 5, 1957. 36p. $6.30(ph OTS); $3.00(mf OTS).

The status of research on the properties and preparation of various U alloys is summarized. (C.H.)

WASTE DISPOSAL

13043 BNL-211(Del.)
Brookhaven National Lab., Upton, N. Y.
PROGRESS REPORT ON FISSION PRODUCTS UTILIZATION. IV. PROPOSALS FOR CONCENTRATING HIGH-LEVEL WASTES. PART 2. F. V. Caccavo, R. J. Isler, and B. Manowitz. Apr. 1, 1953. Decl. with deletions March 6, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

Concepts for design of containers for concentrated Savannah River reactor fission-product wastes are presented. The capacities of containers of various designs, calculations of the specific heat generation of dried fission-product solids in these containers, and radiation distribution in the various containers are discussed. Preliminary results are presented from laboratory studies of the physical constants of waste solids and the viscosity of waste slurries. (C.H.)

13044 LWS-24632
California Research and Development Co., Livermore, Calif.
PROCESS DESIGN FOR THE LIVERMORE WASTE DISPOSAL PLANT. Summary Report. J. L. Schewennesen, L. R. Michels, and M. L. Feldman. Sept. 10, 1952. Decl. Apr. 1, 1957. 29p. (CRD-T1-184). $6.30(ph OTS); $3.00(mf OTS).

Some of the singular problems connected with radioactive waste processing at the Livermore site are outlined. Several methods for treating and disposing of wastes were evaluated. These include disposal at sea in shielded containers following various degrees of concentration, underground storage of neutralized wastes at Livermore, direct dispersion of wastes in large volumes of sea water, and rail or truck shipment to either Hanford or Los Alamos for underground storage at these sites. Approximate costs per year are tabulated for these methods. (B.J.H.)

ENGINEERING

13045 KAPL-M-RGK-1
Knolls Atomic Power Lab., Schenectady, N. Y.
RESULTS OF THE TESTS ON SEVERAL FAST BREEDER FLOW ORIFICES. R. G. Kennison. Oct. 5, 1949. Decl. Mar. 28, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Tests on five venturi-shaped orifices are reported. The requirement was that the ratio of operating-to-standby flow resistance be as high as possible. The 30° venturi designed for a fast breeder support plate thickness of 1.75 in. was found to be the most efficient. (F.S.)

HEAT TRANSFER AND FLUID FLOW

13046 CF-54-5-196
Oak Ridge National Lab., Tenn.
TEMPERATURE GRADIENT AND THERMAL STRESSES IN HEAT GENERATING BODIES. F. A. Field. May 21, 1954. Decl. Apr. 2, 1954. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

13047 KAPL-534(Del.)
[Knolls Atomic Power Lab., Schenectady, N. Y.]
HEAT TRANSFER IV. Nuclear Engineering Course, 1948–1949. R. W. Lockhart. Mar. 3, 1949. Decl. with deletions Feb. 26, 1957. 19p. Contract [W-31-109-Eng-52]. (KAPL-M-NEC-9(Del.)). $4.80(ph OTS); $2.70(mf OTS).

The heat transfer problems associated with reactors are discussed for general cases. (T.R.H.)

13048 TID-10079
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
PARALLEL FLOW HEAT TRANSFER TO WATER IN OPEN LATTICE OF CYLINDRICAL RODS. Feb. 15, 1954. Decl. Apr. 12, 1957. 71p. Contract AT(30-1)-1374. $0.45(OTS).

Heat transfer measurements were made for water flowing parallel to cylindrical rods arranged in a triangular lattice. A 4-inch section in the middle of a 4-ft rod was heated by means of a Nichrome resistance coil encased in the rod. A single rod diameter of 0.625 inch and a single lattice spacing of 0.914 inch center-to-center were studied. A lattice with a circular cross section of $6\frac{1}{4}$ inch diameter, containing 37 rods (plus partial rods where the cylindrical boundary wall intersected the lattice) was used. Water velocity was varied from 5 to 20 fps, water temperature was varied from 150 to 325°F, and heat flux was varied from 50,000 to 200,000 Btu per hr per sq ft of heated surface. Heat transfer coefficients varied from 1,900 to 9,800 over a Reynold's number range of 70,000 to 700,000. The coefficients were about 40% higher than would be predicted by the Colburn equation for water flowing inside pipes. (auth)

MATERIALS TESTING

13049 DP-117
Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.
A CLADDING THICKNESS TESTER FOR FLAT FUEL ELEMENTS. J. D. Ross. Aug. 1955. Decl. Feb. 23, 1957. 16p. Contract AT(07-2)-1. $0.25(OTS).

A tester utilizing eddy currents was developed to measure the thickness of Al cladding on U plates. The instrument measures Al thickness between 0.015 and 0.030 inch to an accuracy of better than ±0.001 inch. The measurement is not affected by a Ni layer between the Al and the U. (auth)

13050 DP-179
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
AN AUTOMATIC FLAW DETECTOR FOR ALUMINUM CANS. John D. Ross. Oct. 1956. Decl. Mar. 13, 1957. 12p. Contract AT(07-2)-1. $0.25(OTS).

A tester, utilizing eddy currents, was developed to detect inclusions and voids in Al cans. The sensing element is a small probe that does not touch the can under inspection. An experimental feeder, developed along with the tester, permits the automatic inspection of one can per minute. (auth)

13051 KAPL-M-LD-2
Knolls Atomic Power Lab., Schenectady, N. Y.
TEST OF FLAT PERFORATED ALUMINUM PLATE FOR STRUCTURAL EFFICIENCY. Test No. 504. Lorenzo Deagle. Mar. 16, 1956. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The design of the S3G (SAR) reactor requires a flat or slightly dished pressure vessel head perforated with 19 holes. The best available theory for determining stress and deformation in plates was originally developed for relatively thin plates with a large number of perforations such as heat exchanger tube sheets. To provide a basis for extending the theory to thick plates such as the pressure vessel head, a test of an aluminum model, built to a scale of approximately $\frac{1}{4}$ of the full size head, was set up. Due to tight schedules which did not provide time for elaborate test fixtures and procedures, it was necessary to design a simple test which would determine qualitatively whether or not the theory was a reasonable approximation on which a safe design of the pressure vessel head could be based. It is concluded that the theory predicts conservation values for stress and deformation in thick, perforated plates of the type tested. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

13052 BMI-893
Battelle Memorial Inst., Columbus, Ohio.
CORROSION OF URANIUM–ZIRCONIUM ALLOYS IN WATER AT TEMPERATURES UP TO 100°C. H. A. Pray and W. E. Berry. Dec. 16, 1953. Decl. Feb. 26, 1957. 26p. Contract W-7405-eng-92. $0.30(OTS).

Under certain conditions, uranium–5 wt. % zirconium alloys exhibit remarkable corrosion resistance in distilled water at 100°C after 1-year's exposure. The alloy must be quenched rapidly (in water or oil) from above 700°C. Subsequent treatments to soften it by annealing at 500 or 600°C or by isothermal treatments have lessened its resistance. Corrosion resistance is also dependent on dissolved oxygen in the test water. The alloy is resistant to 97°C water saturated with hydrogen–oxygen mixtures in ratios up to 25 to 1 but not in excess of 35 to 1. It corrodes when part of a crevice. Harmful effects of surface abrasion can be removed by a nitric acid pickle, and long-time pickling does not impair corrosion resistance. Galvanic coupling uranium–5 wt. % zirconium with aluminum does not adversely affect the corrosion resistance of the alloy. Increasing the zirconium content to about 7.5 wt. % eliminates the alloy's sensitivity to crevice effects and to dissolved oxygen in the test water, while additions in the range of 20 wt. % eliminate the need for special heat treatments. (auth)

13053 FMPC-192
National Lead Co. of Ohio, Cincinnati.
EVALUATION OF GRINDING COOLANTS; CORROSIVE EFFECTS ON URANIUM METAL. Fred H. Meyer. Feb. 24, 1953. Decl. Apr. 3, 1957. 11p. Contract AT(30-1)-1156. $0.25(OTS).

A series of grinding coolants were tested for their corrosion effects on U metal. Both undiluted and various concentrations of coolant-in-water mixtures were used. A standardized test arrangement and rating system were used for evaluating and comparing the coolants. The results are tabulated. (auth)

13054 HW-26928
Hanford Works, Richland, Wash.
CORROSION OF 2-S ALUMINUM IN POTASSIUM TETRABORATE SOLUTION. N. R. Miller. Jan. 22, 1953. Decl. Feb. 28, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A laboratory test was conducted to determine the feasibility of using an uninhibited solution of potassium tetraborate in steam condensate as a material for a pile ink facility. The evaluation was made from the standpoints of 2-S aluminum corrosion, the rate and composition of film build-up on aluminum flow surfaces, and the change of solution composition. (auth)

13055 NYO-1309
Mallinckrodt Chemical Works, St. Louis.
SEMI-FINAL REPORT ON THE CORROSION RESISTANCE OF SEVERAL ALLOYS IN AN HF–H_2O ATMOSPHERE AT HIGH TEMPERATURES. C. F. Ritchie and E. K. Teter. Aug. 3, 1950. Decl. Mar. 12, 1957. 7p. Contract W-7405-eng-29. $1.80(ph OTS); $1.80(mf OTS).

Macroscopic observations on numerous alloys exposed to an HF–H_2O atmosphere at 1070°F are given. The most promising metals or alloys that may be used as materials of construction for UF_4 process equipment are discussed. (W.L.H.)

13056 WAPD-MM-184
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
HYDROGEN PICKUP DURING CORROSION TESTING OF ZIRCONIUM AND ZIRCALOY-2. K. M. Goldman and D. E. Thomas. Feb. 19, 1953. Decl. Mar. 21, 1957. 13p. $1.80(ph OTS); $1.80(mf OTS).

Tabulated data are presented from a study on the rate of H pickup during corrosion testing of arc-melted sponge Zr and Zircaloy-2 as a function of thickness, H content of the water, and initial H content of the metal. The testing temperature was 600°F. Hydrogen contents were measured in specimens after removal from corrosion test without any subsequent surface preparation. (C.H.)

13057 Y-714
Oak Ridge National Lab., Y-12 Area, Tenn.
CORROSION RESISTANCE OF ZIRCONIUM METAL AND STAINLESS STEELS ON EXPOSURE TO CONCENTRATED SOLUTIONS OF URANYL FLUORIDE. C. D. Susano. Jan. 22, 1951. Decl. Mar. 6, 1957. 22p. Contract W-7405-eng-26. $0.25(OTS).

The results of exploratory tests to determine the degree of corrosion resistance of Zr metal and of various grades of stainless steels when exposed to highly concentrated solution of UO_2F_2 up to 100°C are reported. It is concluded that Zr metal is not sufficiently resistant to merit consideration for application in homogeneous reactors. Some tests were made to determine the suitability of chromates, H_2O_2, and triethanolamine for use as corrosion inhibitors, but with no apparent success. It is shown that under the particular conditions used all the various grades of stainless steels are equally and satisfactorily resistant to the corrosive attack of UO_2F_2 solutions at 100°C. (D.E.B.)

METALS AND METALLURGY

13058 ANL-4956
Argonne National Lab., Lemont, Ill.
GROWTH RATES AND MICROSTRUCTURAL CHARACTERISTICS OF 300°C ROLLED URANIUM RODS ON THERMAL CYCLING. Final Report on part of Metallurgy Program 5.1.9. H. H. Chiswik and R. M. Mayfield. June 1953. Decl. June 19, 1957. 22p. Contract W-31-109-eng-38. $0.35(OTS).

The thermal cycling growth and the accompanying metallographic changes were studied in 300°C rolled uranium rods up to 3000 cycles. The growth rate was found to decrease at the higher cycling levels. Project-grade material developed substantial porosity during cycling; high-purity material showed no evidences of porosity. It is suggested that the development of porosity is associated with inclusions in the metal and is not a direct consequence of the mechanism of deformation. The major effect of cycling on the grain structure was that of subgraining, resulting in a grain size only slightly smaller than the starting grain size. No differential elongation of grains in the growth direction was noted. The lack of void formation in high purity material and the lack of differential grain elongation are contrary to what one would predict on the basis of the "ratchet" mechanism for thermal cycling growth proposed by Burke, Howe, and Lacy. (auth)

13059 BM-II-16

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JANUARY 15–FEBRUARY 15, [1952]. Decl. Feb. 16, 1957. 25p. Contract AT(11-1)-140. $6.30(ph OTS); $3.00(mf OTS).

Zr and Hf production is reported. Research and development of the reduction process, improvements in melting techniques, corrosion testing, alloy development, and ingot evaluation are discussed. (J.E.D.)

13060 BM-II-24

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF MARCH 15–APRIL 15, 1952. Decl. Feb. 16, 1957. 21p. Contract AT(11-1)-140. $3.30(ph OTS); $2.40(mf OTS).

Improvements were made in the redistribution of "C" grade Zr sponge. The combined purification-reduction runs continue to operate satisfactorily and attention is now being given to increasing the output of each run. Investigations were started on the production of $ZrOCl_2$ from Zr ores by chemical methods. All Sn additions are now made during the course of the melting by means of a proportional feeder. Further hot water corrosion testing of zircaloy has verified previous work that cold work has no effect on the corrosion rate. It appears that Si has little effect on the corrosion rate of Zr and the addition of 1% Sn will stabilize 1% Si. Impact tests on Zr and zircaloy were made. (auth)

13061 BM-II-37

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JUNE 15–JULY 15, 1952. Decl. Feb. 16, 1957. 23p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Work on the production of Zr and Hf is reported. Included are sections on research and development of the reduction process, improvements in melting techniques, corrosion testing, alloy development, and ingot evaluation. (J.E.D.)

13062 BM-II-38

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JULY 15–AUGUST 15, 1952. Decl. Feb. 16, 1957. 35p. Contract AT(11-1)-140. $6.30(ph OTS); $3.00(mf OTS).

The conversion of Zr ores to water soluble chlorides by means of a caustic fusion and hydrolysis in HCl is discussed in detail and a preliminary flow sheet is presented. Hot water corrosion data shows that "B" grade Zr sponge is highly erratic in behavior. Hot water corrosion data is shown for alloys of Zr and Fe, Ni and Cr with 1% Sn additions. Alloys are promising on the basis of 14 days exposure at 650°F. Zr–Nb–Sn alloys are not as promising as the above alloys. Evaluation data for about 240 Zr–Sn production ingots is tabulated. (J.E.D.)

13063 BM-II-39

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF AUGUST 15–SEPTEMBER 15, 1952. Decl. Feb. 16, 1957. 24p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

The Zirconium Plant produced 22,976 pounds of clean sponge during the period of August 1 to September 1, 1952. No Hf metal was produced during this period. A critical study was made of the methods of sampling zirconium sponge and the results obtained by 11 different procedures are described. Further time studies have indicated that the distillation step can be shortened by about 10 to 12% with a corresponding increase in zirconium production. The arc melting procedure has been changed and the 6-in. diameter ingots produced by consumable melting of 2-in. square pressed bars are now coupled and melted directly to 10-in. diameter ingots without an intermediate working step. The over-all recovery of metal is raised from 55 to 80% by this procedure. Data are presented on the corrosion of Zr–Sn, Zr–Fe, Zr–Ni, Zr–Cr, Zr–Ta, Zr–Nb and Zr–O_2. The 56-day tests at 650°F indicated that 1 to $1\frac{1}{2}$% Sn is just as effective as $2\frac{1}{2}$% Sn. Specimens containing Sn appear to be deteriorating under long time exposures and the role that Sn plays in stabilizing Zr appears somewhat questionable. (auth)

13064 BM-II-42

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF SEPTEMBER 15–OCTOBER 15, 1952. Decl. Feb. 16, 1957. 29p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Production of Zr was 19,431 lb for the month, and Hf for the same period was 431 lb. Further tests on increasing the distillation temperature in the final step of Zr production indicates that the run time can be shortened and higher temperatures used to reduce the nuisance elements Mg and Cl_2. The change from $2\frac{1}{2}$% Sn alloy to "K" or Zircalloy 2 has necessitated changes in the melting addition for production ingots being produced for Mark II. All ingots production for this program are melted by the "610" method, that is 6" dia. ingots melted from 2" sponge electrodes are melted directly to 10" dia. finished ingots. Hot water corrosion data on a number of Zr alloys tested in 650°F water is presented. An evaluation of two production ingots of the "610" type is presented in detail. (auth)

13065 BMI-1149(Del.)

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING NOVEMBER 1956. Russell W. Dayton and Clyde R. Tipton, Jr. Dec. 1, 1956. Decl. with deletions Mar. 1957. 66p. Contract W-7405-eng-92. $9.30(ph OTS); $3.60 (mf OTS).

Research is reported in the development of materials for reactors, development, of Al-clad fuel elements, plant assistance to MCW, reactions between H_2O and Zr alloys, general fuel element development, Zr–U alloys studies, corrosion of Zr, reactor materials development, physical metallurgy, development of PWR, and Na–Ta compatibility at high temperatures. (T.R.H.)

13066 BM-II-48

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF NOVEMBER 15–DECEMBER 15, 1952. Decl. Feb. 16,

1957. 28p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

The production of Zr and Zircaloy 2 and hot water corrosion testing of Zr alloys are presented. Tabulation of production of Hf and Hf products and Zr and Zr products and a summary of ingot analysis are given. (W.L.H.)

13067 BM-II-51

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF DECEMBER 15, 1952–JANUARY 15, 1953. Decl. Feb. 16, 1957. 36p. Contract AT(11-1)-140. $6.30(ph OTS); $3.00(mf OTS).

The progress of the work on the production of Zr and Hf is reported. Tabulation of hot water corrosion testing of Zr alloys is given. (W.L.H.)

13068 BM-II-54

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JANUARY 15–FEBRUARY 15, 1953. Decl. Feb. 16, 1957. 22p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Production figures show that 165 reduction runs were made to produce 16,998 pounds of clean sponge Zr and three reduction runs to produce 611 pounds of Hf. Production of Zircaloy 2 ingot for STR strip amounted to 10,955 pounds of finished ingot. Investigations to determine optimum degree of vacuum for consumable electrode melting for both first and second melting steps have been made. It appears that a vacuum less than 0.1 atmoshphere produces additional operating difficulties in arc control, ingot quality, and ingot removal from the melting cup. Corrosion testing of Zr–Sn–Ta alloys in 600and 680°F water indicates that alloys containing more than 1% Ta in combination with 1% Sn are not corrosion resistant. Nitrogen analyses of single and double-melted Zircaloy 2 ingots strongly suggest that zirconium nitride is decomposed during arc melting. Corrosion studies of unalloyed zirconium show that this material has excellent corrosion resistance after 14 days in 680°F water and 151 hours in 750°F steam. This material which is representative of 20,000 pounds of Kroll process sponge has as average Brinell hardness of 149 and contains 20 ppmof N_2 and 1240 ppm of O_2. (auth)

13069 BM-II-59

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF FEBRUARY 15–MARCH 15, 1953. Decl. Feb. 16, 1957. 21p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Production figures for Zr and Zr alloys and Hf and Hf products for the period are presented. Melting research studies reported include the use of vacuum on the first as well as the second melt and increased size for first melt ingots. Data from corrosion tests of Zr and Zr alloys are summarized. (C.H.)

13070 BM-II-62

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF MARCH 15–APRIL 15, 1953. Decl. Feb. 16, 1957. 27p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Production figures for Zr and Zr alloys and Hf and Hf products for the period are presented. Investigations of the source of O pickup during chlorination and sponge handling steps are described. Data are included on Zr melting development, corrosion testing of unalloyed Zr and of Zr alloys containing 1.8% Sn with varying Fe, Cr, and Ni content, specifications for Zircaloy ingots, and the Hf content of a wide selection of Zr minerals. (C.H.)

13071 BM-II-63

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF APRIL 15–MAY 15, 1953. Decl. Feb. 16, 1957. 17p. Contract AT(11-1)-140. $3.30(ph OTS); $2.40(mf OTS).

Production figures for Zr, Zr alloys, and Hf are presented. Data are included on evaluation of zircaloy ingots, corrosion testing of zircaloy, and corrosion testing of cold-worked Zr. (D.E.B.)

13072 BM-II-68

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF MAY 15–JUNE 15, 1953. Decl. Feb. 14, 1957. 23p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Progress of the work on the production of Hf, Zr, and Zr alloys is presented, and corrosion testing data on Zr alloys are tabulated. Analytical data on Zr–Hf minerals are given. (J.E.D.)

13073 BM-II-70

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF JUNE 15–JULY 15, 1953. Decl. Feb. 13, 1957. 21p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

Production figures for Hf, Zr, and Zircaloy 2 are presented. The analysis of two samples of electrolytic Zr powder is reported. Additional data are presented on the corrosion testing of Zircaloy-2 ingots and of unalloyed and cold-worked Zr in 600°F water and 750°F steam. Results are reported from the analysis of six Zr minerals for Hf, Zr, and rare metals content. (L.M.T.)

13074 BM-II-73

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF AUGUST 15–SEPTEMBER 15, 1953. Decl. Feb. 12, 1957. 23p. Contract AT(11-1)-140.

Progress on the production of Hf, Zr, and Zr alloys is briefly outlined. Corrosion test data on Zr alloys are tabulated. Summaries of the results obtained in the study of derived high-purity concentrates of Zr minerals are given. (J.E.D.)

13075 BM-II-84

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF DECEMBER 15, 1953–MARCH 15, 1954. Apr. 10, 1954. Decl. Feb. 12, 1957. 48p. Contract AT(11-1)-140. $7.80(ph OTS); $3.30(mf OTS).

Hafnium and Zr production figures and a number of improvements in the production process are reported. Hot water corrosion data on Zr and Zr alloys are given. Heat treatments in the temperature range 900 to 1000°C will accelerate the corrosion of Zr–Fe alloys. (J.S.R.)

13076 BMI-894

Battelle Memorial Inst., Columbus, Ohio.

METAL SPRAYING IN INERT ATMOSPHERES. R. E. Monroe, D. C. Martin, and C. B. Voldrich. Dec. 17, 1953. Decl. Feb. 26, 1957. 22p. Contract W-7405-eng-92. $0.30(OTS).

A new and promising method of producing metallic coatings by metal-arc spraying in inert atmospheres was

studied. Zr coatings were deposited on U by this method. These coatings were porous and contained many spray particles which were not satisfactorily flattened out during deposition. A diffusion heat treatment after spraying was effective in eliminating the boundaries between individual Zr particles. As-sprayed and heat-treated Zr coatings had good adhesion to U. However, the study of Zr spraying on U has been discontinued, since other methods of coating now being investigated appear more feasible. (auth)

13077 BMI-913(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROPERTIES OF STAINLESS STEEL–URANIUM DIOXIDE FUEL PLATES. J. R. Keeler and L. J. Cuddy. May 11, 1954. Decl. Mar. 6, 1957. 16p. Contract W-7405-Eng-92. $3.30(ph OTS); $2.40(mf OTS).

A method for fabricating 30-in.-long stainless steel–UO_2 fuel sheet was developed, and the properties of the fabricated sheet were investigated. A core containing 30 w/o of UO_2 was roll clad with 347 stainless steel. The core matrix consisted of iron–18 w/o chromium–9 w/o nickel, prepared by powder-metallurgy methods from the elemental powders. The resulting sheet was 0.020 in. thick and had 0.004 in. of cladding per side on a 0.012-in.-thick core. The rolled sheet was 34 in. long by 2½ in. wide. The tensile strength of the composite sheet at temperatures up to 1300°F was measured, and the creep properties in this temperature range were determined. The stability of the sheet during thermal cycling was excellent. The electrical resistivity was determined to provide data for the electrical heating of fuel elements in simulated-service tests. (auth)

13078 BMI-1090(Del.)
Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF METHODS FOR END CAPPING STAINLESS STEEL PINS. Julius J. Vagi, Harold B. Thompson, and David C. Martin. May 18, 1956. Decl. Apr. 17, 1957. 38p. Contract W-7405-eng-92. $0.40 (OTS).

Investigations were made of methods for sealing the ends of stainless steel-clad, stainless steel-oxide dispersion fuel pins. Brazing, flash welding, resistance-upset welding, and induction welding were studied. Flash welding resulted in expulsion of core material to the outer surfaces, and resistance-upset welding gave inconsistent and unsatisfactory welds. Induction welding offered promise for welding the cladding-to-cap bond, but weld penetration could not be kept less than the cladding thickness. Results of brazing tests indicated that additional development work would be required to define the exact conditions for brazing. (auth)

13079 BMI-X-132
Battelle Memorial Inst., Columbus, Ohio.
STATUS OF AN ALTERNATE CONTROL MATERIALS PROGRAM. R. W. Dayton. Oct. 15, 1956. Decl. Feb. 15, 1957. 12p. $3.30(ph OTS); $2.40(mf OTS).

The radiation stability of the physical properties of various B and B-compound dispersion in Ti and Zircaloy was studied. The Zircaloy-clad Ti–B dispersion is considered as a possible alternate control rod material. Clad Ti–B dispersion containing various addition of B are evaluated for bond integrity and particle characteristics. (J.E.D.)

13080 BNL-75
Brookhaven National Lab., Upton, N. Y.
LIQUID REACTOR FUELS: BISMUTH – URANIUM SYSTEM. D. W. Bareis. Sept. 15, 1950. Decl. Feb. 13, 1957. 15p. $0.25(OTS).

The liquidus curve for the system Bi–U has been determined for the temperature range of 271° to 700°C. This system appears most promising for a liquid reactor fuel. A thermal power reactor using this fuel would have to operate above 400°C. A suitable container material for this fuel must be developed. (auth)

13081 CF-52-1-144(Del.)
Oak Ridge National Lab., Tenn.
CERAMIC MATERIALS AS RELATED TO THE REACTOR PROGRAM. J. R. Johnson. Jan. 18, 1952. Decl. with deletions Mar. 14, 1957. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A brief review of reactor technology is presented. Physical properties of ceramic materials of interest to the reactor program are reviewed. The properties of 63 ceramic materials and some metals which might be used in reactor fuel elements, moderators, structures, or shields, are presented in tabular form. Sites carrying out ceramic work of interest to the reactor program are listed and a summary of work being done at key sites is included. General conclusions are presented concerning the usefulness of ceramics in reactors. (C.H.)

13082 CP-2314(Rev.)
[Chicago, Univ.]. Metallurgical Lab.
SLUG TEMPERATURES IN AN OFF-CENTER ANNULUS. H. R. Kratz, R. Peterson, and R. Schlegel. Nov. 10, 1944. Decl. Mar. 7, 1957. 26p. Contract [W-7401-eng-37]. $0.35(OTS).

Temperatures are measured at two points in an internally heated jacketed slug which is cooled by water flowing in an off-center annulus around the slug. The variations of these temperatures with water velocity, water temperature, power, and the amount the annulus is off center are measured. The temperature near the slug surface which approaches and comes in contact with the water jacket does not increase as much as anticipated. The temperature near the slug surface on the side which is moved away from the water jacket increases nearly as much as on the side approaching the slug. An explanation for this unexpected increase of temperature on the side moving away from the jacket is given. (auth)

13083 ISC-25
Ames Lab., Ames, Iowa.
PROGRESS REPORT IN METALLURGY. Aug. 1, 1948. Decl. Mar. 27, 1957. 35p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported in the following studies: the preparation and properties of metallic Th; the preparation of Th chloride; the purification of Ca; the preparation of Be fluoride; the reduction of Be; the preparation and properties of rare earth metals; the preparation and properties of alloys of Bi–Th, Pb–Th, and Ca–Ni alloys; and the purification of graphite. (C.H.)

13084 KAPL-876(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
IODIDE DECOMPOSITION PROCESS FOR COATING URANIUM WITH ZIRCONIUM. W. L. Robb and F. J. Shipko. Feb. 24, 1953. Decl. with deletions Feb. 25, 1957. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Corrosion-resistant Zr coatings have been consistently deposited on U disks by the de Boer or iodide decomposition process. Four-mil coatings can be deposited in three hours at U temperatures of 1090°C and at pressures below one micron. Corrosion tests in boiling water on five disks coated in this way yielded an average time of 263 hours until coating failure. In a flow system which used H_2 as carrier and reductant for the Zr iodide, only very thin coatings were obtained. Poor coatings also resulted from attempts to plate with lower U temperatures using other metal halides both in vacuum and in a flow system. (auth)

13085 KAPL-903
Knolls Atomic Power Lab., Schenectady, N. Y.
A CATHODIC SPUTTERING TECHNIQUE TO PRODUCE UNIFORM FOILS OF FISSILE MATERIAL. H. E. Soisson and J. C. Sheffield. Apr. 20, 1953. Decl. Mar. 28, 1957. 33p. Contract W-31-109-Eng-52. $0.25(OTS).

A technique is described for producing thin adherent films of fissile material on thin aluminum foil. For surface densities of 0.01 to 0.6 mg/cm^2, a uniformity within ± 1.5% of the average has been achieved for foils up to 50 cm^2. Methods of measuring the uniformity of the surface density of the films, uses of the prepared foils, and the determination of the number of atoms of fissile material in a film are discussed. (auth)

13086 KAPL-1354(Rev.)
Knolls Atomic Power Lab., Schenectady, N. Y.
STAINLESS STEEL–UO_2 DISPERSION FUEL ELEMENTS —HOT DRAWING STUDY. D. P. Petarra and A. H. Alberts. June 15, 1955. Decl. Mar. 14, 1957. 11p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The technique of hot-drawing has been studied as a possible final step of a three part program for the development of a stainless steel–UO_2 dispersion-type fuel element. A versatile, easily controllable method of obtaining uniform rod temperatures has been devised. The effects of drawing temperature and amount of reduction per pass have been determined. (auth)

13087 KAPL-1380(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
PREPARATION OF SPHERICAL URANIUM POWDER BY REDUCTION OF URANIUM TRIOXIDE WITH CALCIUM. A. P. Beard and F. K. Heumann. July 22, 1955. Decl. with deletions Feb. 25, 1957. 39p. Contract W-31-109-eng-52. $0.40(OTS).

The reduction of UO_3 with Ca metal in a bomb, at elevated temperatures, provides an excellent method for making spherical U particles. The yields of metal are high (90 to 95%) and ~50% of the pellets are larger than 325 mesh (43 microns). Spherical U particles are of interest for use in a long-lived fuel element, consisting of such particles dispersed homogeneously in a matrix of a ductile, nonfissionable metal or alloy. (auth)

13088 KAPL-1526(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGY REPORT OF THE TECHNICAL DEPARTMENT [FOR] DECEMBER 1955, JANUARY, FEBRUARY 1956. C. A. Bruch, W. M. Cashin, and D. W. White. Decl. with deletions Feb. 25, 1957. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Phase diagrams for U–Zr alloys have been constructed and ceramic coatings of U are being considered. High- and low-temperature properties of uranium oxides are being investigated. The thermal properties of irradiated alkali and alkaline earth uranates are being studied and work continues on the solubility properties of nonaqueous solvents, for use as electrolytes. (F.S.)

13089 KAPL-M-ERH-1
Knolls Atomic Power Lab., Schenectady, N. Y.
LEAK PLUGGING OF STRESS CORROSION CRACKS WITH COMMERCIAL BOILER SEALING COMPOUNDS. E. R. Harris and G. E. Galonian. Mar. 28, 1956. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Three commercial boiler sealing compounds, Met-L-Seal, Leakure, and "X"-Liquid, were tested as to their ability in plugging stress-corrosion leaks found in the S1G evaporator's T-347 stainless steel tubing. Results indicated that at 160 psig (solution inside tubing) and at 500 psig (solution outside tubing) 1:50 mixtures of Leakure and "X"-Metal formed strong plugs capable of withstanding approximately 500 psig which did not seem to be significantly affected by gamma irradiation. (T.W.S.)

13090 KAPL-M-KOK-2
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGICAL EXAMINATION OF GRISCOM-RUSSELL EVAPORATOR DOUBLE TUBE TO TUBE SHEET SPECIMEN. K. H. Koopman. Aug. 17, 1956. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Results are reported for a metallurgical examination of an evaporator specimen fabricated from Type-304 stainless steel. The specimen had been exposed to severe thermal cycling (simulating S3G reactor start-up and scram conditions) in order to determine the reliability of the tube-to-tube sheet weld. (T.W.S.)

13091 KAPL-M-KOK-4
Knolls Atomic Power Lab., Schenectady, N. Y.
INVESTIGATION OF THE FAILURE OF AN S1G SOUND ISOLATING STEAM FITTING. B. E. Harper and K. H. Koofman. Sept. 20, 1956. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A sound isolating steam fitting failed in service when a welded joint between type 321 stainless steel and medium carbon steel cracked and allowed steam to escape. The intergranular cracking, due to high stresses from differential thermal expansion, was believed to have occurred during the original welding operation joining the stainless steel to carbon steel. (auth)

13092 KAPL-M-LRM-12
Knolls Atomic Power Lab., Schenectady, N. Y.
THE PHYSICAL PROPERTIES OF U–Be ALLOYS. L. R. McCreight. Jan. 1954. Decl. Mar. 13, 1957. 6p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The literature on UBe_{13} is quite limited, however, there are many references to each of the constituents. From these data, the physical properties of UBe_{13} and mixtures of Be–UBe_{13} or Be–UO_2 can be predicted. This memo, therefore, contains some predictions of properties and a compilation of available information. In general, the properties of UBe_{13} appear to be about the same as for Be with the exception of ductility. The ductility of Be is almost zero at room temperature and the ductility of UBe_{13} is apparently even less. Dilute mixtures of UBe_{13} and Be would be expected, however, to be suitable for fuel elements if they were in simple shapes (e.g. pins or rods) and were canned or clad. (auth)

13093 KLX-1737
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES–NUCLEAR ASPECTS. Quarterly Progress Report For August 1–October 31, 1954. Job 1099. Nov. 30, 1954. Decl. Mar. 1, 1957. 47p. Contract AT(30-1)-850. $0.45(OTS).

Optimum conditions for sintering metallic coatings were investigated, and data are presented on the effects of reduction temperature, sintering temperature, and heating schedule on nickel, Nichrome, stainless steel, and Inconel compositions. It was found that metallic coatings greater than 0.5-mil thick required slow heat-up to form crack-free surfaces on Cu plates and that a deeply etched surface aided in promoting adherence. Preliminary results are reported on the densification of Inconel composition on mild steel by rolling, pressing, and peening. An investigation was made of techniques for forming metal-bonded alumina coatings by co-deposition with reducible oxides; however, these coatings had no strength of firing tests up to 1200°C. Data are presented on the calibration and operating characteristics of an automatic recording electromagnetic balance designed to evaluate the parameters of electrophoretic deposition. A

complete electronic circuit is presented, and photographs of the balance are included. In operating the balance, the sensing element is made the plating electrode on which deposition of material occurs, and the weight of deposit is recorded as a function of time. A comparison was made of calculated versus experimental deposition rate as estimated from magnetic balance data. Studies were made of parameters such as the age effect of a dispersion on the plating rate, methods of dispersion preparation, plating as a function of current flow through the dispersion, and factors affecting the cracking due to shrinkage upon drying of coatings of inorganic oxides on metal surfaces. Data are presented on the electrophoresis of Cr_2O_3, NiO, and Fe_2O_3 dispersed in alcohol and the effects of addition of $NiCl_2$ solution on electrophoresis of NiO dispersed in alcohol. (C.H.)

13094 LWS-24898(Del.)
California Research and Development Co., Livermore, Calif.
PLUTONIUM ALLOYS AND COMPOUNDS FOR SOLID FUEL OR CONTROL ELEMENTS IN FAST REACTORS. R. M. Fulrath and D. R. Mash. July 21, 1953. Decl. with deletions Feb. 26, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Control of fast reactors is best accomplished by the use of shim rods. The properties required in shim rods for use in the FBR are reviewed, and available Pu compounds are considered for application. The use of a $PuNi_2$ alloy or $PuSi_2$ system is indicated. (D.E.B.)

13095 NYO-1201
Brush Beryllium Co., Cleveland.
QUARTERLY PROGRESS REPORT FOR JANUARY, FEBRUARY, AND MARCH 1954. A. J. Stonehouse, comp. May 15, 1954. Decl. Mar. 12, 1957. 29p. Contract AT(30-1)-541. $4.80(ph OTS); $2.70(mf OTS).

Current development work on the extraction of Be from beryl ore with fluoride agents is discussed. The effects of high hot pressing pressures and increased BeO content upon the properties of QMV beryllium are presented. Conditions for the successful sintering of green beryllium compacts and the fabrication of beryllium-clad fuel elements are described. Preliminary properties of a 3% Fe–Be alloy showing promise as a high temperature material are given. Correlation of previous work and work during the current quarter has resulted in the determination of an optimum power input range for the levitation of carbon from uranium melts by the application of vibrational energy. (auth)

13096 NYO-3728
Horizons, Inc., Cleveland.
INVESTIGATIONS FOR THE PRODUCTION OF THORIUM METAL. Technical Progress Report [for] Fourth Quarter, February 1 to April 30, 1953. Merle E. Sibert. May 25, 1953. Decl. Mar. 30, 1957. 16p. Contract AT(30-1)-1335. $1.80(ph OTS); $1.80(mf OTS).

A continuation of the investigation of the possibilities for Th production by fused salt electrolysis is presented. The metal produced by the electrolysis of $KThF_5$ and of $NaThCl_5$, was found to be of approximate equivalent quality with respect to purity, hardness, and workability. The chloride process is to be preferred over the fluoride because of its potentiality for continuous operation and its simpler procedure for the preparation of the source electrolyte. (J.E.D.)

13097 NYO-3730
Horizons, Inc., Cleveland.
INVESTIGATIONS FOR THE PRODUCTION OF THORIUM METAL. TECHNICAL PROGRESS REPORT [FOR] SIXTH QUARTER, SEPTEMBER 1 TO NOVEMBER 30, 1953. Jason C. Bleiweiss. Dec. 1, 1953. Decl. Mar. 30, 1957. 20p. Contract AT(30-1)-1335. $3.30(ph OTS); $2.40 (mf OTS).

The process for producing $NaCl-ThCl_4$ as a cell feed material by melting $(NH_4Cl)_2ThCl_4$ with NaCl under a chlorine atmosphere proved to be satisfactory. The determination of electrolysis conditions for maximum efficiency was carried out in a cell capable of producing 150 to 300 g of Th metal per cathode. Increasing the Th ion concentration while maintaining a cathode current density of about 185 amps/dm^2 resulted in increased current efficiency, increased metal recovery, and lower hardness Th product. Electrolysis in the intermediate-sized cell capable of producing 5 to 10 lb of metal per cathode can commence shortly in view of the satisfactory results thus far obtained in the determination of electrolysis conditions in the smaller cell. (auth)

13098 NYO-3788
Naval Research Lab., Washington, D. C.
A STUDY OF PREFERRED ORIENTATION IN ROLLED URANIUM BARS BY MEANS OF SONIC AND ULTRASONIC VIBRATIONS. S. D. Hart, E. W. Kammer, and I. Vigness. Oct. 15, 1953. Decl. Mar. 30, 1957. 13p. Contract AT(30-1)-1344. (NRL-4263). $0.25(OTS).

Elastic inhomogeneities exist in certain rolled uranium bars submitted for study by means of flexural vibrations and ultrasonic pulses. Heat treatment at a temperature above the alpha-beta transition point, referred to as beta treated, reduces the elastic inhomogeneity to a degree not observable by the ultrasonic techniques employed. However, for all of these beta treated bars, flexural vibration results still indicated nonuniformity in behavior best explained by vestigial elastic inhomogeneities. (auth)

13099 TID-5256(Rev.)
[Metallurgy Development Advisory Committee, AEC].
URANIUM INCLUSIONS—TECHNICAL PAPERS OF NINTH METALLOGRAPHIC GROUP MEETING OCTOBER 27, 1954, [AT BATTELLE MEMORIAL INSTITUTE]. H. P. Roth, comp. Apr. 26, 1955. Decl. Mar. 1, 1957. 113p. $0.70(OTS).

Results of studies of the inclusions in U and its alloys are reported. The development of an ultrasonic drill for the extraction of inclusions in U is described. Inclusions in U due to N_2 and H_2 are identified. Metallographic examinations for the identification of inclusions were made on U–Fe and U–Si alloys and reject commercial slugs. (C.W.H.)

13100 TID-10047
Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL PROPERTIES OF ALLOYS OF THE URANIUM–ZIRCONIUM SYSTEM. G. T. Muehlenkamp, W. Chubb, and A. D. Schwope. Oct. 20, 1953. Decl. Mar. 16, 1957. 11p. Contract W-7405-Eng-92. $0.25(OTS).

The tensile properties at room temperature and 700°F and the dynamic Young's modulus up to 1000°F were determined on two series of alloys containing from 0 to 100 wt. % Zr in U. One alloy series was made by induction melting, using Fernald U; the other was made by arc melting and contained Derby U. Alloys at the high-Zr end of the $\alpha + \epsilon$ region were 55% stronger than unalloyed U at room temperature and about 300% stronger than U at 700°F. Correspondingly, the alloys of this composition were less ductile. In the ϵ-phase region, the strength decreased quite rapidly with increasing Zr content; however, no increase in ductility was apparent. In the $\epsilon + \delta$ phase region, the strength first remained fairly constant and then decreased rapidly as the Zr content approached 100%. The elongation increased rapidly in this $\epsilon + \delta$ region. The dynamic modulus of elasticity decreased with increasing Zr content. This decrease was not linear and differed

somewhat for the two series of alloys. The trend was the same at all temperatures up to 1000°F. Specimens from these two series of alloys elongated or contracted a maximum of 0.3% during thermal cycling 500 times from 100 to 500°C. (auth)

13101 TID-10108
National Lead Co. of Ohio, Cincinnati.
DEVELOPMENT OF MELTING AND CASTING PRACTICE FOR THORIUM WITH MODIFIED DODGE FURNACE. P. L. Kleinsmith, W. B. Clymer, J. A. Stanley, R. F. Bravard, and S. L. Reese. July 6, 1954. Decl. Mar. 20, 1957. 10p. Contract AT(30-1)-1156. $0.25(OTS).

The alterations made in the Th dezincing and casting furnaces have resulted in a vacuum induction-heated furnace suitable for melting and casting but not for dezincing. As a result of the studies made to date, the ability of this furnace to cast a 500-lb. 7 in.-diameter Th ingot with a furnace cycle of approximately 3½ hours has been demonstrated. Ingot surfaces are sufficiently good to indicate that surface scalping may no longer be necessary. The use of stabilized zirconia crucibles for at least 10 heats is indicated. Improvement in casting practice has resulted in the elimination of the zirconia mold hot top, pouring block, and pouring lip and their replacement with graphite. The use of molds in excess of 20 heats is indicated. (auth)

13102 WAPD-83(Del.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
A MODIFIED CATHODIC VACUUM ETCHING PROCEDURE WITH VERSATILE METALLOGRAPHIC APPLICATIONS. T. R. Padden and F. Cain, Jr. May 25, 1953. Decl. with deletions Mar. 4, 1957. 25p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

13103 WAPD-FE-152
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
FUEL ELEMENT ANNEALING. EXPERIMENT 3d6. H. R. Hoge. May 26, 1954. Decl. Mar. 19, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Fuel plate warping during subassembly welding was believed to stem from residual cold-work stresses. Annealing experiments indicate plate warping is not caused by residual stress, but by welding strain. (D.E.B.)

13104 WAPD-FE-525
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
REPORT ON EXPERIMENT 2a6 HARDNESS OF ZIRCALOY-B. H. R. Hoge. Dec. 3, 1954. Decl. Mar. 20, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

The effect of melting, remelting, and fabrication on the hardness of Zircaloy-B fuel alloy was studied. The increased hardness, making fabricability more difficult, was found due to impurity pickup during forging and rolling, and chopping. (T.R.H.)

13105 WAPD-PWR-FE-1192
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
DETERMINATION OF CAUSE AND MEANS OF PREVENTION OF WELD POROSITY IN PWR END CLOSURE WELDS. R. L. Fischer and A. H. Kasberg. [Apr. 1956]. Decl. Mar. 18, 1957. 39p. $6.30(ph OTS); $3.00(mf OTS).

Gross porosity, which frequently exceeded 60% of the cladding thickness, was found in the critical seal area of some of the early PWR development fusion welded end closures. The origin of porosity was traced to subsurface foreign material, principally located on the inside of drawn Zircaloy fuel tubes, which volatilized during welding. Removal of this foreign material by adequate preweld tube conditioning methods results in a reduction of weld porosity to a tolerable level. The amount of preweld conditioning required for fuel tubes has been found to vary considerably, and to have a strong correlation to the amount of conditioning employed during fabrication. (auth)

PHYSICS

13106 KAPL-M-FAW-2
Knolls Atomic Power Lab., Schenectady, N. Y.
INDUCED FISSION COUNTING OF FUEL DISCS. F. A. White. Oct. 26, 1948. Decl. Mar. 29, 1957. 8p. Contract W-31-109-Eng- 52. $1.80(ph OTS); $1.80(mf OTS).

Measurements were made on the induced fission counting rate of U^{235} fuel discs of the Sacandaga reactor. As a result of these measurements a criterion can be established to yield an approximate determination of the U^{235} isotope. This presumes that the discs are of the same thickness and also that a number of discs of known isotopic value are available for use as standards. It has also been suggested that induced fission counting of fuel discs might give a check on some of the results of the sigma pile. (auth)

13107 LWS-24712
California Research and Development Co., Livermore, Calif.
CRITICAL MASS STUDY FOR CYLINDRICAL GEOMETRY AS A FUNCTION OF RADIUS TO HEIGHT RATIO. Robert A. Weir. Jan. 20, 1953. Decl. Mar. 13, 1957. 6p. (CRD-R-30). $1.80(ph OTS); $1.80(mf OTS).

The results are presented of a study on the manner of variation of the critical mass of Pu and the peak-to-average power production ratio in a bare cylindrical reactor core. The particular case considered was that of a Pu, U, Fe, and Pb composite. Results indicate that increasing the ratio of critical radius to critical height from 0.5 to 1.0 would entail an increase in critical mass of 22%. (B.J.H.)

ISOTOPE SEPARATION

13108 A-78(Del.)
Fertilizer Research Lab., Washington, D. C.
THE SEPARATION OF ISOTOPES OF MERCURY IN A TEN-CELL APPARATUS BY THE CASCADE EVAPORATION METHOD. Progress Report. A. K. Brewer and S. L. Madorsky. Nov. 25, 1940. Decl. with deletions Feb. 12, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

Experiments were carried out in a 10-cell iron apparatus at an external pressure of $\sim 10^{-6}$ mm Hg. Data indicate that the theoretical separation factor can be approached by the cascade evaporation method. The method is not necessarily limited to Hg. An modification in which the vapor is blown from cell to cell either by the vapor pressure of the liquid itself or by an inert gas is suggested to save power and extend the applicability of the method to a wide range of compounds. (G.Y.)

13109 A-2363
Standard Oil Co. of Indiana, Chicago.
A STUDY OF THE REACTIONS OF METHYL ETHER–BORON FLUORIDE COMPLEX WITH WATER UNDER FRACTIONATION CONDITIONS. E. N. Hiebert, W. L. Rittschof, and A. L. Conn. Oct. 31, 1945. Decl. Feb. 12, 1957. 50p. Contract W-7418-eng-41. $9.30(ph OTS); $3.60(mf OTS).

MATHEMATICS

13110 KAPL-M-SES-12
Knolls Atomic Power Lab., Schenectady, N. Y.
LOG REACTOR MODEL. William W. Sherman. Apr. 9,

1956. 26p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

The behavior of a reactor when being started up from very low power levels was studied. The principal problems studied were usable shim rate, tolerable shim overshoot and backlash in the mechanism, required accuracy in log flux indication, and allowable accuracy and delay in period indication, and allowable accuracy and delay in period indication. A 3 delay group model was set up and worked. (M.H.R.)

MEASURING INSTRUMENTS AND TECHNIQUES

13111 NRF-ER-65

Westinghouse Electric Corp. Atomic Power Div., Idaho Falls, Idaho.

DETERMINATION OF THE EFFECT OF ALUMINUM SHIELDS ON LARGE PULSES IN THE S1W BF-3 PROPORTIONAL COUNTERS. R. J. Tinder. Jan. 9, 1957. 3p. $1.80(ph OTS); $1.80(mf OTS).

Aluminum shields were found to have no effect on large spurious pulses which were observed on the S1W BF_3 proportional counters, Type WL-3584 installed in a reactor nuclear instrument panel. (C.H.)

NEUTRONS

13112 KAPL-M-LOB-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE CALCULATED FAST NEUTRON FLUX FROM A SOURCE PLATE FOR A HIGH PRESSURE CELL. L. G. Bishop and J. H. Smith. Oct. 8, 1956. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The calculated fast neutron flux inside a thick-walled steel cylinder, as produced by each of several different external fast sources, is given. (auth)

NUCLEAR PHYSICS

13113 NAA-SR-Memo-56(Del.)

North American Aviation, Inc., Downey, Calif.

PROGRESS REPORT FOR MAY 1951. July 15, 1951. Decl. with deletions Feb. 27, 1957. 23p. Contract AT-11-1-gen-8. $4.80(ph OTS); $2.70(mf OTS).

Reactor calculations, materials, and liquid metal system corrosion for an optimized plutonium power reactor are briefly summarized. Results of a heat transfer study for a high temperature reactor are tabulated. Preliminary results on the corrosion of Mo, Ta, and graphite in liquid metals are also tabulated. Work was continued on the mechanical properties of materials at high temperatures. Some properties of graphites are listed. Fuel preparation techniques for the Low Power Research Reactor are summarized. Exponential experiments are described. Data are included on the effect of cold work and irradiation on the low temperature electrical resistivity of copper. Surface hardness measurements on 347 stainless steel welds in NaK are summarized. Work on the Materials Testing Accelerator was also continued. (B.J.H.)

13114 ORNL-1663

Oak Ridge National Lab., Tenn.

ELECTRONUCLEAR RESEARCH DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 20, 1953. F. T. Howard, ed. Mar. 3, 1954. Decl. Feb. 22, 1957. 35p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Nuclear physics research with 22-Mev protons produced by the 86-in. cyclotron included investigations of (p,t) reactions, measurement of angular distributions of fission fragments produced by (p,f) on Th, investigation of proton diffraction patterns, measurement of (p,pn) and (p,an) excitation functions, and identification of several new isotopes. In an investigation of the long-range prospects for the production of neutron-deficient isotopes in the 86-in. cyclotron, yield calculations were made for (p,n) and (p,2n) reactions, and new types of targets were developed. The magnetic field of the 63-in. nitrogen cyclotron was modified to improve the deflected beam; a C^{3+} beam was used to determine the range energy relation for carbon ions in emulsion. The 44-in. test cyclotron is being modified to permit operation with larger currents at higher energy. A preliminary study was made of an r-f system suitable for use in a variable-energy heavy-particle cyclotron. Preliminary tests in preparation for the separation of gram quantities of enriched Pu isotopes were completed; the efficiency and yields obtained in the calutron are much less for Pu than for U. A preliminary design study for a 10-megawatt pressurized-water package reactor power plant for operating in remote areas was completed; a plant producing 1000 kw of electricity and 3500 kw for heating would cost approximately $\$1.7 \times 10^6$, exclusive of fuel, installed locally; the kwh cost for producing electricity and steam at 70% load is 5.52 and 1.37 cents, respectively. A total ion (lithium) current in excess of 6 amp was obtained in the apotron with only three arcs in operation. (auth)

NUCLEAR PROPERTIES

13115 WASH-189

[Nuclear Cross Sections Advisory Group, AEC.]

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, WHITE PLAINS, NEW YORK, OCTOBER 10 AND 11, 1955. C. W. Zabel. June 4, 1956. Decl. Mar. 6, 1957. 39p. $0.40(OTS).

The cross section measurement programs of various laboratories are briefly summarized, and some preliminary data are included. (B.J.H.)

13116 WASH-190

[Nuclear Cross Sections Advisory Group, AEC.]

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, HOUSTON, TEXAS, FEBRUARY 22 AND 23, 1956. C. W. Zabel. June 5, 1956. Decl. Mar. 5, 1957. 37p. $0.40(OTS).

Reports presented to the AEC Nuclear Cross Sections Advisory Group for consideration at the February 22 and 23, 1956 meeting at Houston, Texas are reviewed. These reports are not intended to be complete and formal reports covering all the work of the laboratories involving neutron cross section measurements, but rather contain an informal statement of recent developments, changes in emphasis, and preliminary data, consideration of which is important to the cross section measurement program of the AEC. (auth)

13117 WASH-191

[Nuclear Cross Sections Advisory Group, AEC].

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, LOS ALAMOS, NEW MEXICO JUNE 11 AND 12, 1956. C. W. Zabel. Oct. 23, 1956. Decl. Mar. 5, 1957. 60p. $0.50(OTS).

Recent developments, changes in emphasis, and preliminary data from various laboratories on cross section measurements are briefly summarized. (F.S.)

NUCLEAR REACTORS

13118 AECU-3538

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

FUNCTIONAL REQUIREMENTS OF FUEL HANDLING

SYSTEM. R. Flaherty and P. A. Halpine. Jan. 16, 1956. 11p. Contract AT-11-1-GEN-14. (FR-1003-B). $3.30 (ph OTS); $2.40(mf OTS).

13119 BNL-376
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] DECEMBER 1955. R. W. Powell. Decl. Feb. 14, 1957. 18p. $0.30(OTS).

Reactor loading, operating levels, downtime, and general maintenance are reported. Fuel element removals, fabrications, and failures are given. Materials irradiated are tabulated. (D.E.B.)

13120 BNL-382
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JANUARY 1956. R. W. Powell. Decl. Feb. 13, 1957. 17p. $0.30(OTS).

13121 BNL-385
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] FEBRUARY 1956. R. W. Powell. Decl. Feb. 14, 1951. 17p. $0.30(OTS).

Power levels, slug charging and discharging, and special irradiations for the month are tabulated. (D.E.B.)

13122 BNL-393
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MARCH 1956. R. W. Powell. Decl. Feb. 12, 1957. 23p. $0.30(OTS).

Reactor operations are briefly summarized, and special irradiations are listed. (B.J.H.)

13123 BNL-398
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] APRIL 1956. R. W. Powell. Decl. Feb. 13, 1957. 17p. $0.30(OTS).

Reactor operations are briefly summarized and special irradiations are listed. (F.S.)

13124 BNL-405
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MAY 1956. R. W. Powell. Decl. Feb. 14, 1957. 18p. $0.30(OTS).

13125 BNL-411
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JUNE 1956. R. W. Powell. Decl. Feb. 14, 1957. 21p. $0.30(OTS).

13126 BNL-413
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JULY 1956. R. W. Powell. Decl. Feb. 14, 1957. 17p. $0.30(OTS).

13127 BNL-416
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] AUGUST 1956. R. W. Powell. Decl. Feb. 13, 1957. 20p. $0.30(OTS).

13128 CEPS-1129
Commonwealth Edison Co. CEPS Group, Chicago and Public Service Co. of Northern Ill. CEPS Group, Chicago.
REPORT ON THE FEASIBILITY OF A 12' I.D. PRESSURE VESSEL PROPOSED FOR THE CEPS-1111 DESIGN. Apr. 27, 1953. Decl. Feb. 15, 1957. 17p. $0.25(OTS).

The design and possible fabrication of a reactor pressure vessel for a light-water moderated reactor which is approximately 10 ft. long by 12 ft. in diam. with a 9 ft. diam. full-opening head are presented. (J.E.D.)

13129 CF-52-8-148(Chap. I)(Del.)
Oak Ridge School of Reactor Technology, Tenn.
REACTOR MATERIALS. G. E. Evans. Sept. 9, 1952. Decl. with deletions Feb. 13, 1957. 40p. $6.30(ph OTS); $3.00(mf OTS).

This report describes factors in reactor materials selection and includes considerations of neutron economy, corrosion and radioactivity problems, radiation damage, significance of power density, classification of materials by function, choice of fuel and moderator, choice of structural materials and coolants, and choice of shielding materials. (L.T.W.)

13130 CF-52-11-228
Oak Ridge National Lab., Tenn.
AN ON-OFF SERVO FOR THE ARE. S. H. Hanauer, E. R. Mann, and J. J. Stone. Nov. 25, 1952. Decl. July 5, 1957. 14p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Fuel temperature is used to govern the servomechanism which operates the ARE control rod. The mechanism circuitry is given and its operation is described. (D.E.B.)

13131 CF-52-12-226
Oak Ridge National Lab., Tenn.
CRITICALITY CALCULATIONS FOR THE ISHR. M. Tobias and P. N. Haubenreich. Dec. 16, 1952. Decl. Apr. 2, 1957. 15p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Calculations have been made for the 6 ft. diameter ISHR core to determine the enrichment-temperature-concentration relationships when the reactor solution is in an unpoisoned condition. Isotherms are shown covering the temperature range between 100°C and 275°C and concentrations from 48 gms U/kg D_2O to 1190 gms U/kg D_2O. A curve of enrichment vs. temperature at a concentration of 305 g U/kg D_2O [β = 39 atoms D_2O/atom U], and a curve of concentration vs. temperature at an enrichment (γ) equal to 0.0245 atoms 25/atom U, were constructed from the isotherms. In addition, for each temperature, the solution concentration for criticality at an enrichment equal to 0.935 was calculated. (auth)

13132 CF-53-1-317
Oak Ridge National Lab., Tenn.
DELAYED NEUTRON ACTIVITY IN THE ARE FUEL CIRCUIT. H. L. F. Enlund. Jan. 27, 1953. Decl. July 5, 1957. 9p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

13133 CF-53-5-21
Oak Ridge National Lab., Tenn.
ENERGY PER FISSION AND POWER OF THE BSR. J. L. Meem, E. B. Johnson, and H. E. Hungerford. May 12, 1953. Decl. Mar. 9, 1957. 10p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The energy per fission in the BSR has been re-measured and the new value is given (see ORNL-1537 (in preparation) for detailed information). Using this result and the recalibration results of the ORNL Graphite Reactor (ORNL-1398), the absolute power of the BSR has now been determined within a few percent. All experimental data from the BSR from this date will be based on the new absolute power unless otherwise stated. All previous data should be corrected. A list of reports in which corrections should be made is included. (L.M.T.)

13134 CF-53-12-1
Oak Ridge National Lab., Tenn.
CALCULATIONS FOR THORIUM- AND URANIUM-FUELED

REACTORS. P. N. Haubenreich. Feb. 8, 1954. Decl. Feb. 13, 1957. 78p. Contract [W-7405-eng-26]. $0.55 (OTS).

A study was made of the feasibility of producing power in large-scale aqueous homogeneous reactors. Reactor types which were considered include both one- and two-region systems with either Th or U as feed material. In analyzing the costs of operation it was necessary to know feed rates, processing rates, and inventories of fissile and fertile material. The nuclear calculations are presented. The assumptions, the constants, and the methods used for each reactor are described in detail. Some results are also included. (C.H.)

13135 CF-54-7-11
Oak Ridge National Lab., Tenn.
FUEL ACTIVATION METHOD FOR POWER DETERMINATION OF THE ARE. E. B. Johnson. July 31, 1954. Decl. July 5, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

13136 CF-54-10-152
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR FUEL AND BLANKET STUDIES. PRODUCTION OF ThO_2. G. C. Williams. Oct. 6, 1954. Decl. Apr. 17, 1957. 24p. Contract [W-7405-eng-26]. $0.35(OTS).

Conditions, techniques and materials of construction shown to be desirable for the production of ThO_2 from thorium nitrate tetrahydrate by an oxalate precipitation, double calcination procedure are presented. A survey of suggested methods of production, a critique on these methods, and supporting data for choice of conditions are appended. (auth)

13137 CF-54-11-1
Oak Ridge National Lab., Tenn.
HRT RECOMBINER CONDENSER DESIGN. R. E. Aven. Nov. 1, 1954. Decl. Apr. 17, 1957. 44p. Contract [W-7405-eng-26]. $0.40(OTS).

Equipment has been designed to recombine the D_2 and O_2 gas released in the core of the HRT and to condense the D_2O after recombination. The recombiner is in the form of a cylindrical annulus packed with platinized alumina pellets. The condensing unit consists of 62 U tubes housed in a stainless steel shell. Cooling water is passed through the tubes, and D_2O vapor is cooled and condensed on the outside of the tubes. During a dump of the fuel solution, the recombiner condenser will be used to recombine decomposition gases which are normally dissolved in the fuel solution and to condense vapors formed from the core material. Design data and calculations are presented. (M.P.G.)

13138 CF-55-6-157
Oak Ridge National Lab., Tenn.
BREEDING REACTORS. M. Tobias. June 7, 1955. Decl. Feb. 23, 1957. 22p. Contract W-7405-eng-26. $0.35(OTS).

A general discussion is given on the terminology and theory of breeding. Sodium cooled fast reactors, such as the Experimental Breeder Reactor, and aqueous homogeneous reactors are discussed in more detail. (W.L.H.)

13139 CF-56-1-145
Oak Ridge National Lab., Tenn.
FUEL COST OF POWER REACTORS FUELED BY $UO_2SO_4-Li_2SO_4-D_2O$ SOLUTION. H. C. Claiborne and T. B. Fowler. Jan. 30, 1956. Decl. Feb. 14, 1957. 27p. Contract [W-7405-eng-26]. $0.35(OTS).

The economics of $UO_2SO_4-Li_2SO_4-D_2O$ reactor systems which produce power only is considered. The results for a 1000 Mw spherical, one-region reactor operating at 330°C, delivering 300 Mw of electric power are given. The solution-type fuel is economically competitive with slurry fuel. (T.R.H.)

13140 CF-56-3-159
Oak Ridge National Lab., Tenn.
CRITICAL EXPERIMENTS FOR A PROPOSED TOWER SHIELDING REACTOR. D. W. Magnuson and A. D. Callihan. Mar. 28, 1956. Decl. May 9, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

13141 HW-26692(Del.)
Hanford Works, Richland, Wash.
INTERIM REPORT ON EXAMINATION OF POWDER METALLURGY SLUG FROM PT-105-313-4M. D. P. O'Keefe. Jan. 5, 1953. Decl. with deletions Feb. 28, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

A uranium slug, which had been produced by powder metallurgical methods, was observed to have become deformed during pile exposure of 424 Mwd/t. The slug had a slightly bumpy surface over about one-half of its length. This bumpy portion of the slug had increased in diameter, and the remainder of the slug had decreased in diameter. The length of the slug was greater than the manufactured length. (L.T.W.)

13142 IDO-16353
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ADVANCED TESTING REACTORS. J. R. Huffman, W. P. Conner, G. H. Hanson. May 28, 1956. 11p. Contract AT (10-1)-205. (PTR-81). $3.30(ph OTS); $2.40(mf OTS).

A definite need exists for reactors which will provide higher neutron fluxes and other improved environmental conditions in order to provide the testing requirements of future reactors. Three general types of testing reactors appear necessary to satisfy the majority of the most important experiments: thermal and/or fast advanced materials testing reactors, an integrated set of facilities in each of which a single large experiment can be tested, and ETR-type reactors which appear to be an adequate transition between advanced materials tests and the verification of whole reactors or large segments thereof. Concerning studies of reactor materials, since the radiation damage from thermal neutrons at very high values of nvt is expected to be of major importance and since reactors of the future may employ fluxes of a few times 10^{14}, it is desirable to provide a thermal flux of the order of 5×10^{15} for materials and components testing. Based on the demand of radiation-damage experiments for the highest fast flux regions in the MTR, there will also be an ever increasing need for higher and higher fast flux. We recommend that the design and construction of an advanced materials testing reactor having a thermal flux of 5×10^{15} and small test holes, 3 in. by 3 in., be given a high priority. This reactor should be designed to operate at the highest temperature and pressure consistent with ease and economy of operation. (auth)

13143 IDO-16359
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NUCLEAR CALCULATIONS FOR SPERT III ZIRCONIUM CORE. G. A. Cazier and B. L. Hanson. Oct. 1, 1956. 30p. Contract AT(10-1)-205. (PTR-110). $0.25(OTS).

All the currently available information on the nuclear core constants and geometry of the SPERT III Zr core is summarized, and the results of preliminary critical size and excess reactivity calculations are reported. Calculated critical radii and critical masses are given at 68, 460, and 650°F, all for a core with 3-ft-long fuel assemblies. (L.T.W.)

13144 IDO-16363

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

VARIATION OF FUEL REQUIREMENTS FOR FIXED MTR OPERATING CYCLES. G. A. Cazier. Sept. 7, 1956. 5p. Contract AT(10-1)-205. (PTR-118). $1.80(ph OTS); $1.80 (mf OTS).

The upward trend of fuel requirements for MTR operation is examined. A curve is plotted showing the effective critical mass as a function of cycle time. The curve passes through a maximum, and this rules out the possibility that poison ingrowth is a serious factor. However, the evidence does not rule out the possibility of poison ingrowth; but it does suggest that other factors, most likely the experimental load, are most important. (auth)

13145 IDO-16365

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EFFECT OF CYCLE TIME OF MTR WITH 20% ENRICHED FUEL DUE TO CHANGES IN METAL/H_2O VOLUME RATIO. H. L. McMurry. Oct. 15, 1956. 10p. Contract AT(10-1)-205. (PTR-123). $1.80(ph OTS); $1.80(mf OTS).

A proposed increase in the thickness of the fuel plates in the 20% enriched fuel assemblies to be tested in the MTR raised questions of the effect on charge life due to the resulting increase in metal/H_2O ratio. To reveal this effect for the MTR an examination was made of operating data obtained between charges 18 and 23 when the average metal/H_2O ratio was decreased between successive charges. From these data a graph has been constructed of weighted critical mass as a function of core metal/H_2O ratio. From the slope of this curve plausible estimates of changes in charge life due to changes in core metal/H_2O ratio are possible. In this way it is estimated that increasing the thickness of the plates in the 20% enriched fuel assemblies from 0.050 inches to 0.060 in. will cost 130 Mwd of operating life in the Geneva core. Using this graph and other data, it is found that decreasing the number of 0.060 in. fuel plates per assembly from 19 to 18 results in a net loss in charge life of ~150 Mwd. (auth)

13146 IDO-16367

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EQUATIONS FOR MTR BURNUP APPORTIONMENT. F. P. Vance. Dec. 3, 1956. 7p. Contract AT(10-1)-205. (PTR-146). $3.30(ph OTS); $2.40(mf OTS).

A set of equations is derived for use in computing percentage burnup of U^{235} in the MTR attributable to each lattice position occupied by a fuel element. It is shown that the use of five equations is adequate to define the 29 percentages, within significant differences. (L.T.W.)

13147 K-126

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

CRITICAL MASS STUDIES. Part II. C. K. Beck, A. D. Callihan, and Raymond L. Murray. Jan. 23, 1948. Decl. Mar. 25, 1957. 48p. $0.40(OTS).

Using uranium enriched with 30% U^{235} fabricated with fluoroplastic into cubes having nuclear properties of UF_6, a study was made of factors affecting the mass assembled at criticality. The effect of intermixed hydrogen, type of reflector, density of U^{235}, homogeneity, and geometric shape are considered. (auth)

13148 K-314

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

REVERSING TIME OF HIGH-FLUX PILE CONTROL ROD. J. Sandock, A. E. Johnson, and T. A. Kirkham. Nov. 18, 1948. Decl. Mar. 27, 1957. 14p. Contract W-7405-Eng-26, Subcontract 70. $0.25(OTS).

Plots of rod position vs. time were obtained. These plots showed that the repositioning time (time required for the rod to reverse and return to the position it occupied when the reversing signal was given) was 0.57 sec when no cooling water flowed. Repositioning time decreased with an increase in flow of cooling water. Experiments were recommended to determine whether part of the repositioning time was attributable to a delaying relay which was not an essential part of the system, and to determine whether the repositioning time could be reduced by using a more suitable motor. It was found that the inertia force which the rod exerted on the magnet during reversal was negligible compared to the force exerted in steady motion. (auth)

13149 KAPL-341(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

PROGRESS REPORT NO. 45 [FOR] APRIL 1950. SECTION IV. REACTOR ENGINEERING. May 23, 1950. Decl. with deletions Feb. 21, 1957. 60p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90(mf OTS).

The status of SIR development is briefly reviewed. The status of construction of the special facility for studying liquid metal heat transfer and flow properties is given. Extensive studies were made of liquid Na reaction rates in H_2O-alcohol mixtures, thermal stress distribution in long, thin-walled tubes, electromagnetic pump performance, and bearing behavior in liquid metals. The results of these studies are given. (D.E.B.)

13150 KAPL-743

Knolls Atomic Power Lab., Schenectady, N. Y.

VARIATION OF FAST FISSION EFFECT WITH HOMOGENEITY IN INFINITE SLAB REACTOR. F. H. Clark, May 19, 1952. Decl. Mar. 27, 1957. 46p. Contract W-31-109-Eng-52. $0.30(OTS).

Variation of fast fissions in U^{238} with homogeneity of reactor is examined for two different cases of infinite slab reactors. General results are obtained which are extrapolated to finite rod reactors. Some applications to reactor problems are given. Curves of the results for various values of U^{238} to moderator ratio are included. (auth)

13151 KAPL-M-AMS-7

Knolls Atomic Power Lab., Schenectady, N. Y.

INITIAL INSOLATION VALVE REPORT; SAR PROJECT. E. R. Hottenstein. Oct. 15, 1954. Includes Addendum No. 1. 27p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

13152 KAPL-M-CJB-2

Knolls Atomic Power Lab., Schenectady, N. Y.

THE EFFECT OF NON-AXIAL LOADS ON THE STRUCTURE OF HANFORD SLUG JACKETS. C. J. Beck. June 1, 1953. Decl. Mar. 9, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

13153 KAPL-M-EDL-10

Knolls Atomic Power Lab., Schenectady, N. Y.

CONTROL CYLINDER GUIDE BEARING TESTS. Test Nos. 3, 3A, and 4. J.E. Robinson, Jr., D. B. Vail, and A. W. Bedford, Jr. Jan. 5, 1953. Decl. Mar. 2, 1957. 37p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30 (mf OTS).

The characteristics of a prototype control cylinder guide bearing under operating conditions in liquid Na were observed. Bearing of Carboloy 779 and Carboloy 55A were tested, and their friction and wear properties are reported. The maximum friction coefficient observed was

0.5. The coefficient was essentially stable throughout the test; independent of load, and increasing slightly with temperature. (D.E.B.)

13154 KAPL-M-EL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G COLD WATER ACCIDENT ANALYSIS. Edward Lantz. Apr. 27, 1956. 34p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A single node reactor model assuming slab geometry and a single delayed neutron decay constant is used to investigate the seriousness of the S3G cold water accident in order to help determine a satisfactory safety system and operating procedure for the reactor. (auth)

13155 KAPL-M-ELS-3
Knolls Atomic Power Lab., Schenectady, N. Y.
PRELIMINARY STUDY OF THE INSTRUMENTATION FOR THE EMERGENCY COOLING TEST LOOP. F. D. Leipziger and E. L. Shirley. Feb. 29, 1956. 15p. Contract W-31-109-Eng-52 . $3.30(ph OTS); $2.40(mf OTS).

A method is outlined for measuring temperature gradients across emergency cooling piping as a function of flow rate. By first adding a soluble colored salt to the coolant, it should be possible to determine density coefficients across $10\frac{1}{2}$ in. piping colorimetrically as indicated by the amount of light transmitted by the colored solution. (T.W.H.)

13156 KAPL-M-GJB-2
Knolls Atomic Power Lab., Schenectady, N. Y.
SODIUM FLUSH PROGRAM. G. J. Barenborg. Nov. 12, 1954. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A research program for development of a sodium flush procedure for the SIR is described. The purpose of the procedure would be to allow early access to the lower reactor compartment following operation. (T.R.H.)

13157 KAPL-M-JBP-1
Knolls Atomic Power Lab., Schenectady, N. Y.
COMPOSITION OF FPR-1, 2, 2A, AND 3A. J. B. Paniszczyn. May 24, 1956. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

This report describes the composition and geometry of the four assemblies which have been brought to criticality in the Flexible Plastic Reactor (FPR) Critical Facility. (T.W.S.)

13158 KAPL-M-KAK-9
Knolls Atomic Power Lab., Schenectady, N. Y.
ENGINEERING DIVISION TERMINATION REPORT ON THE POWER-BREEDER REACTOR. K. A. Kesselring. May 31, 1950. Decl. Feb. 23, 1957. 309p. Contract W-31-109-Eng-52. $51.50(ph OTS); $11.10(mf OTS).

The West Milton Area Project was concerned with the development of the KAPL Intermediate Power Breeder Reactor. The status of engineering effort on the West Milton Area Project at the time of termination of the project is reviewed. Termination reports are included covering reactor design status; instrumentation; reactor control; reactor assembly; coolant control system; controls for fuel loading, handling, transfer, and storage systems; reactor cooling systems; reactor service facilities; liquid metal heat transfer system; remote valve operating mechanisms; the liquid metal valve program; liquid heating system; liquid metal screen; pit heating and blanketing systems; overflow and makeup systems; reactor control facilities; reactor containers; and design of the fuel element service building. (C.H.)

13159 KAPL-M-KAK-10
Knolls Atomic Power Lab., Schenectady, N. Y.
ENGINEERING STUDY OF OFF-ON CONTROL FOR SIR TYPE POWER UNITS. K. A. Kesselring. Sept. 27, 1954. Decl. Mar. 7, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A general engineering review of the desirability and feasibility of off-on control for the SIR type power units was made from a reactor power unit standpoint. Off-on control results in simpler, more reliable, and cheaper control drive units for SIR type power units. Plant operation is not adversely affected. Maneuverability, recovery from scram, can equal or better Mark B requirements. The use of burnable poisons is not necessary to achieve outstanding benefits from off-on control but would definitely simplify the engineering problems. (auth)

13160 KAPL-M-LGB-9(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
NOTES ON THE CALCULATION OF DOPPLER TEMPERATURE COEFFICIENTS. L. G. Barrett. Sept. 30, 1955. Decl. with deletions Feb. 8, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Available methods of calculation for intermediate reactors are reviewed. Curves are plotted which show the relative contribution of a given type of resonance to the over-all coefficient. The calculation of the Doppler coefficient of U^{235} is hindered due to resonance parameter experimental uncertainties. (auth)

13161 KAPL-M-PLH-16
Knolls Atomic Power Lab., Schenectady, N. Y.
CALCULATION OF REACTIVITY COEFFICIENTS FOR HAFNIUM, CADMIUM, AND BORON FOR VARIOUS SAMPLE THICKNESSES. P. L. Hofmann. May 25, 1954. Decl. Mar. 9, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Reactivity coefficients of samples of Hf, Cd, and B of various thicknesses have been calculated by means of perturbation theory at the center and core edge of the clean PPA-18. Calculated and experimental results are compared. (auth)

13162 KAPL-M-RGK-10
Knolls Atomic Power Lab., Schenectady, N. Y.
THERMAL STABILITY CHARACTERISTICS OF A CANTILEVERED FUEL ROD. R. G. Kennison. Jan. 7, 1953. Decl. Mar. 9, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

An analysis is made of the deflection curve for a rod cantilevered from its bottom end in a matrix tube. It is found that the SIR fuel rod will be thermally self-stabilizing only for diametrical heat generation ratios less than 1.10. (auth)

13163 KAPL-M-RWD-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE EFFECTS OF CHANNELS ON CONTROL AND POWER DISTRIBUTION FOR A MOVING FUEL REACTOR. R. W. Deutsch. Mar. 28, 1955. Decl. Mar. 12, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A preliminary design survey is reported on a moving fuel reactor in which approximately half the fuel loading is in the stationary core, while the remaining fuel is in the movable drums. The drums are separated from the stationary core by a water-metal channel. The channel region replaces part of the fuel, reflector, and blanket regions. Data are presented on the control power distribution, and reactivity under a variety of operating conditions. (C.H.)

13164 LA-1579
Los Alamos Scientific Lab., N. Mex.
TOPSY, A REMOTELY CONTROLLED MACHINE FOR THE STUDY OF CRITICAL ASSEMBLIES. R. H. White.

June, 1953. Decl. Apr. 1, 1957. 34p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

The construction, operation, and typical uses of Topsy, the versatile, remotely controlled, critical assembly machine at Pajarito are described. Section 1 covers the mechanical design of the machine, and the hydraulic and electrical operation of the various components. Section 2 describes how Topsy is used for investigation reacting metal assemblies. Procedures for establishing a delayed critical configuration and operation at delayed critical are illustrated for the U^{235}–U system. Also included are brief descriptions of U^{235}–Ni, Pu–U, and low density and concentration assemblies that have been made on the machine. (auth)

13165 LA-2052
Los Alamos Scientific Lab., N. Mex.
NONWEAPONS ACTIVITIES AT LOS ALAMOS SCIENTIFIC LABORATORY. PART III. POWER REACTOR EXPERIMENTS. Samuel Glasstone. June 1956. Decl. May 9, 1957. 44p. Contract W-7405-eng-36. $0.45(OTS).

The research program at Los Alamos on homogeneous reactors, fast reactors, and the Los Alamos Power Reactor Experiment is summarized. (C.H.)

13166 LAMS-786
[Los Alamos Scientific Lab., N. Mex.]
SAFETY TESTS ON HAND STACKING OF U-235 CUBES. V. Josephson. Oct. 11, 1948. Decl. Apr. 4, 1957. 23p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

Procedures and results for critical assembly tests made on Topsy, to determine safety limits of hand stacking cubes of enriched U^{235} in spherical geometries preparatory to making critical assemblies of U^{235} with normal U tamper, are given. Tests were made of pseudospheres and the critical masses and diameters of these configurations are included. (F.S.)

13167 LWS-22708 (Del.)
California Research and Development Co., Livermore, Calif.
CONCEPTUAL DESIGN OF A ONCE-THRU-CORE, SOLID FUEL FBR. J. A. Quinville, T. P. Heckman, and R. E. Kelly. July 22, 1953. Decl. with deletions Feb. 27, 1957. 33p. $6.30(ph OTS); $3.00(mf OTS).

Preliminary design studies on a 500 Mw, Pu fueled, one-pass, high-burnup, power breeder reactor are reported. Nuclear properties, heat balance, fuel processing, and economics are analyzed. (D.E.B.)

13168 LWS-24719
California Research and Development Co., Livermore, Calif.
PRELIMINARY PBR HEAT TRANSFER STUDY. C. C. Old. Jan. 23, 1953. Decl. Mar. 29, 1957. 11p. (CRD-R-25). $3.30(ph OTS); $2.40(mf OTS).

The thermal properties of a power breeder reactor operating at 500 Mw with a reasonable critical mass were studied. The reactor is designed to have a liquid metal fuel surrounding a tube through which coolant is passed. (F.S.)

13169 LWS-24944 (Del.)
California Research and Development Co., Livermore, Calif.
CONCEPTUAL DESIGN OF A WIRE-CLOTH CORE FBR. B. W. Ela, Jr. July 29, 1953. Decl. with deletions Feb. 26, 1957. 29p. $6.30(ph OTS); $3.30(mf OTS).

From results of a preliminary evaluation, it was concluded that the use of wire cloth as a fuel bearing medium holds great promise of meeting the various design criteria of a power reactor core. The geometrical properties of wire cloth permit a wide choice of wire diameter and wire cloth mesh to meet a desired porosity and heat transfer requirements. Preliminary metallurgical studies indicate suitable fuel enrichment may be achieved and that the fuel-bearing matrix can be formed into wires with suitable weaving properties. Eventual remote wire drawing and wire cloth weaving appears feasible. Reactor core compositions can be obtained that require relatively low critical masses of fuel. Reactor cores with average specific powers of 2.0 or more can be handled adequately. Pressure drop through the fuel bed can be completely controlled by varying the number and thickness of annuli. The obtainable steam temperature is strongly influenced by wire diameter and the thermal conductivity of the fuel-bearing matrix. Factual thermal conductivity data is required before the design can be optimized. Effects of low thermal conductivity can be overcome by use of small wire diameters. Favorable fabrication economy may be realized by the use of wire cloth and wire drawing since both are well established industrial processes. The full potentialities of the wire cloth are still unrealized. Present investigation of variables indicate still more improvements are possible. (auth)

13170 MTRL-54-60
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EFFECT ON FLUX OF HIGH URANIUM (235) CONCENTRATION IN THE MTR. J. W. Webster. July 15, 1954. Decl. Feb. 26, 1957. 4p. Contract AT(10-1)-205. $1.80 (ph OTS); $1.80(mf OTS).

The use of borated fuel assemblies with high fuel content in the MTR was proposed. Some calculations are given which investigate the effects this will have on the neutron flux in various experimental holes. (T.R.H.)

13171 NAA-SR-34
North American Aviation, Inc., Los Angeles.
DESIGN STUDY OF A LOW-POWER RESEARCH REACTOR. A. S. Thompson and T. Fahrner. Oct. 14, 1949. Decl. Apr. 10, 1957. 39p. $7.80(ph OTS); $3.30(mf OTS).

It is concluded on the basis of safety, utility, and cost that the best low power reactor for research institutions would have a D_2O-cooled homogeneous core of graphite impregnated with U_3O_8. The operating power would be 130 kw with a maximum neutron flux of $10^{12}/cm^2$ sec for research purposes. A design and cost estimates are given for such a reactor. (T.R.H.)

13172 NAA-SR-140
North American Aviation, Inc., Downey, Calif.
A MEASUREMENT OF THE NEUTRON TEMPERATURE IN A NATURAL URANIUM D_2O LATTICE. A. T. Biehl and E. R. Cohen. Sept. 25, 1951. Decl. Mar. 28, 1957. 23p. Contract AT-11-1-GEN-8. $0.25(OTS).

An experimental determination of the mean neutron temperature in the fuel rods of a natural U–D_2O lattice using rods 1-in. in diameter on two different cell spacings is reported. The temperature of the neutrons was found to be 35° ± 25°C and 33° ± 16°C above ambient room temperature for the two lattices. The experimental technique used was to compare the flux distributions in a unit cell in (1) a normal hot multiplying lattice and (2) a single U slug in a cold, Pb–Cd alloy, non-multiplying lattice. This allowed a comparison to be made between diffusion length and absorption cross section of the U in the two cases, and accordingly, a comparison between the mean temperatures of the neutrons in the two lattices. (auth)

13173 NAA-SR-148
North American Aviation, Inc., Downey, Calif.
A MEASUREMENT OF THE NEUTRON TEMPERATURE EFFECT USING EUROPIUM OXIDE FOILS. A. T. Biehl,

E. R. Cohen, and D. Woods. Sept. 25, 1951. Decl. Feb. 27, 1957. 20p. Contract AT-11-1-GEN-8. $0.25(OTS).

A method of measuring the effective neutron temperature in a multiplying lattice using Eu foils is described. The principle underlying these measurements is the deviation of the cross section of Eu from a 1/v law at thermal energies. By comparing the ratio of Au-foil activity to Eu-foil activity in a thermal flux at room temperature to this same ratio measured in the thermal flux in a multiplying lattice, it is possible to deduce the temperature of the lattice. This technique was applied to a lattice consisting of $^3/_4$-in.-diam. U rods clad in 0.1-cm-thick Al tubing, spaced on a 6-in.-square cell in D_2O moderator. Analysis of the results of the measurements indicates an average neutron temperature increase of 14% in the U rods and 6% in the D_2O moderator. Comparison is made with other neutron temperature determinations. (L.T.W.)

13174 NAA-SR-Memo-233
North American Aviation, Inc., [Downey, Calif.]
WATER FLOW REQUIRED AFTER SHUTDOWN FOR THE CONVERTER REACTOR. W. C. Cooley and H. Sletten. Feb. 29, 1952. Decl. Mar. 1, 1957. 12p. Contract [AT-11-1-gen-8]. $3.30(ph OTS); $2.40(mf OTS).

It is shown that the water flow required after shutdown for the CR-1 design is determined by the heat produced in Th assemblies, principally by absorption of γ rays from the U^{235} fission products. If the Th cladding temperature is not to exceed 185°F, it is estimated that a total water flow of at least 18,000 gal/min is required immediately after shutdown from 310 Mw power. During the first 2 min after shutdown, the water flow may be gradually reduced to 6000 gal/min. (auth)

13175 NAA-SR-Memo-306
North American Aviation, Inc., Downey, Calif.
MOCK-UP FOR THE CONVERTER REACTOR. A. Benton. Apr. 24, 1952. Decl. Feb. 27, 1957. 7p. Contract [AT-11-1-Gen-8]. $1.80(ph OTS); $1.80(mf OTS).

A proposed mock-up for the Converter Reactor is presently conceived which will consist of a portion of the converter lattice surrounded by a natural U-H_2O buffer lattice which in turn might be surrounded by D_2O or some other moderator. The water boiler will act as a source for this subcritical assembly. The first of a series of calculations designed to assist in selecting the dimensions of the various regions and the composition of the buffer zone are presented. As a starting point, an inner lattice, one foot cube in dimensions, surrounded by a cylindrical buffer was selected. In the analysis, the cube and cylinder are each replaced by spheres, the volume of each sphere being equal to that of the region which it replaces. (auth)

13176 NAA-SR-Memo-530(Del.)
[North American Aviation, Inc., Downey, Calif.]
A SODIUM-COOLED, GRAPHITE-MODERATED PACKAGE POWER REACTOR. Dec. 5, 1952. Decl. with deletions Feb. 27, 1957. 57p. $10.80(ph OTS); $3.90(mf OTS).

A plant utilizing a sodium cooled, graphite moderated reactor for the production of 14 Mw of electrical power is described. This reactor is considered to be superior to other designs previously studied for the "package power reactor" objective. General features of all parts of the reactor, cooling system and power plant are given. Some possible alternate arrangements of the reactor are discussed together with cost analyses. Using a conservative method of estimating, power from the plant recommended in this memorandum is determined to cost approximately 27 mills/kw hr. (auth)

13177 ORNL-527(Del.)
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PRELIMINARY PROCESS DESIGN REPORT. Quarterly Report. Technical Div. C. B. Graham, C. H. Secoy, I. Spiewak, E. H. Taylor, A. M. Weinberg, C. E. Winters, and J. L. English. Dec. 28, 1949. Decl. Mar. 18, 1957. 110p. Contract W-7405-eng-26. (Supersedes AECD-3980). $16.80(ph OTS); $5.70(mf OTS).

A description and discussion of the general feasibility of a 200 to 1000 kw pilot model homogeneous reactor are presented. Topics discussed include design data, reactor control, cost estimates, and the corrosive effects of uranyl sulfate for Zr. Schematic sketches illustrate the design proposals. (C.H.)

13178 ORNL-967
Oak Ridge National Lab., Tenn.
SHIELDING REACTOR CORROSION STUDIES. Arnold R. Olsen. July 9, 1951. Decl. Mar. 2, 1957. 19p. Contract W-7405-eng-26. $0.25(OTS).

The investigation of corrosion in filtered water of MTR-type fuel elements simulated in this study by samples of 2S and 72S-clad 2S Al and an Al brazing alloy for the Shielding Reactor is reported. The study included two basic types of protection: element pretreatment, by either anodizing or alodizing; and solution control, using nitric acid to maintain a pH of 5.5 to 6.5 or the addition of 60 ppm of Na_2CrO_4 or K_2CrO_4 as an inhibitor. No pretreatment was effective in stopping pitting attack for more than 4 months as a maximum. Control of the pH tended to reduce pitting attack and at the same time reduce the over-all corrosion rate to essentially zero. (auth)

13179 ORNL-1062
Oak Ridge National Lab., Tenn.
BOILING REACTORS: A PRELIMINARY INVESTIGATION. J. M. Stein and P. R. Kasten. Dec. 12, 1951. Decl. Mar. 2, 1957. 69p. Contract W-7405-eng-26. $0.45(OTS).

Kinetic equations have been developed for a boiling-type reactor and inherent reactor stability studies have been made on the basis of these equations. Solution reactivity changes cause nuclear power oscillations which are negatively damped by bubble delay times but critically damped by the delayed neutron effect. The over-all result is a highly damped oscillation for instantaneous reactivity changes of about 0.009 and delay times of the order of 0.01 second. Features of the proposed reactor are presented and compared with circulating types, the "boiler" appearing quite attractive if investigations of bubble-rise velocities, effects of transient conditions of vapor mass in steam chest, and bubble time delay functions yield favorable results. (auth)

13180 ORNL-1094
Oak Ridge National Lab., Tenn.
A MANUAL OF HRE CONTROL AND INSTRUMENTATION. L. R. Quarles and W. P. Walker. Jan. 23, 1952. Decl. Mar. 2, 1957. 112p. Contract W-7405-eng-26. $0.55 (OTS).

This manual is prepared to furnish data which will aid in designing the instrumentation and control of future large-scale homogeneous power-producing reactors. The various features outlined are, reactivity control, nuclear instrumentation, rod drive, process instruments and control, alarm annunciator and safety circuit. (J.E.D.)

13181 ORNL-1171
Tennessee. Univ., Knoxville.
THE MOTION OF GAS BUBBLES IN THE HRE REACTOR CORE. F. N. Peebles. Jan. 18, 1952. Decl. Mar. 12, 1957. 46p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 257. $0.35(OTS).

A theoretical study of the motion of gas bubbles in a rotating liquid is presented to make comparison with experimental data from an investigation concerning the removal

of gas bubbles from rotating liquids. A literature review, an expression for the radial velocity of a gas bubble in a rotating liquid, and a method for computing the steady state gas hold-up in the HRE reactor core under power producing conditions are presented. (M.H.R.)

13182 ORNL-1463
Oak Ridge National Lab., Tenn.
METHODS OF FABRICATION OF CONTROL AND SAFETY ELEMENT COMPONENTS FOR THE AIRCRAFT AND HOMOGENEOUS REACTOR EXPERIMENTS. J. H. Coobs and E. S. Bomar. Mar. 30, 1956. Decl. Feb. 21, 1957. 17p. Contract W-7405-eng-26.

The method evolved for preparation of cylindrical inserts for the ARE control and safety rods required the hot-pressing of mixtures of B_4C with alumina and with Fe. A technique for fabrication of control plates for the HRE was devised to minimize defects found in earlier sets of plates. The method involved closely packing pressed-powder compacts in a frame and then hot-rolling to bond protective cladding sheets to the core. (auth)

13183 ORNL-1634
Oak Ridge National Lab., Tenn.
PRELIMINARY CRITICAL ASSEMBLY FOR THE MOLTEN FLUORIDE REACTOR EXPERIMENT. Dunlap Scott and Dixon Callihan. Nov. 18, 1953. Decl. July 2, 1957. 59p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

A zero power mock-up of the Molten Fluoride Reactor Experiment was constructed in the ORNL Critical Facility. The assembly was BeO moderated and reflected and used a powder mixture of Zr, Na, and enriched U, simulating the reactor fuel, packed in stainless steel tubes as fuel elements. The clean critical mass, without the regulating and safety rods, was 5.8 kg of U^{235} to be compared to the predicted value of 5.5 kg. The addition of the regulating rod guide assembly at the center of the reactor increased the critical mass to 6.68 kg. The value of the regulating rod was $1.25 or 1.25 times the effective delayed neutron fraction for this reactor. The calibration of one safety rod gave a value of approximately $5.50. Neutron flux distributions were measured by comparing bare In and Cd covered In foil activations at various points in the reactor. The power distribution was found by measuring the fission fragment activity on Al catcher foils placed in contact with a fused U bearing salt contained in an Inconel tube. The spatial distribution of those neutrons capable of producing fission was measured in the moderator and reflector using the same catcher foil method with a metallic disk. The reactivity contributions by a number of materials, primarily constituents of the structural components, were measured. The radial importances of fuel and fuel containers were determined by the reactivity coefficient method as was the contribution of a partial mock-up of a steel pressure shell. (auth)

13184 ORNL-2021
Oak Ridge National Lab., Tenn.
PRELIMINARY RESULTS OF APPR CRITICAL EXPERIMENTS. PART I. D. V. P. Williams. Nov. 25, 1955. Decl. May 9, 1957. 6p. Contract [W-7405-eng-26]. (CF-55-11-122). $1.80(ph OTS); $1.80(mf OTS).

APPR critical experiments were made in an assembly analogous to the APPR design and consisting of 45 fuel boxes in a 7 × 7 array contained in water. Enriched U metal enclosed in stainless steel plates was used to simulate fuel plates. Results of the experiments are given. (B.J.H.)

13185 TID-10015
Argonne National Lab., Lemont, Ill.
THE HEAVY WATER PRESSURIZER POWER REACTOR (CP-7). Samuel Untermyer. Apr. 7, 1952. Decl. Mar. 15, 1957. 18p. Contract W-31-109-eng-38. $0.15(OTS).

This reactor would produce 1100 Mw of heat (about 240 Mw of net useful electric power). It would operate at 600 psia pressure, and would use Zr clad, natural U plate fuel elements. The reactor tank would be a 15 ft right cylinder. Provision would be made to remove and replace fuel elements during operation, without shutting down the reactor. (auth)

13186 TID-10032
Battelle Memorial Inst., Columbus, Ohio.
TEMPERATURE DISTRIBUTIONS IN A REACTOR FUEL PLATE. J. W. Chastain, J. K. Long, R. F. Redmond, R. E. Grimble, and R. W. Dayton. Sept. 25, 1953. Decl. Mar. 20, 1957. 54p. Contract W-7405-eng-92. $0.40 (OTS).

A large-scale model simulating one channel of a fuel subassembly, proposed for the SCW reactor, was built. This subassembly consisted of alternate flat and corrugated fuel plates. The channel walls of the model were heated electrically and the heat was removed by a coolant flowing through the model at atmospheric pressure. The temperature distribution around the periphery was measured for various coolants and flow rates, chosen to bracket reactor conditions. From these data, local heat-transfer coefficients were calculated. The model coefficients were interpolated to obtain an isothermal distribution of heat-transfer coefficients for three stations along the reactor channel. These heat-transfer coefficients and data on heat transfer to supercritical water in circular tubes were used to calculate the temperature field in the fuel plates of the subassembly. The method of cyclic heat was used to measure the average heat-transfer coefficient in the subassembly. The experimental data are plotted as Stanton number versus Reynolds number. (auth)

13187 UCRL-1855
California. Univ., Berkeley. Radiation Lab.
THREE GROUP EQUATIONS FOR A MULTIPLYING MEDIUM. F. L. Adelman. June 11, 1952. Decl. Mar. 22, 1957. 2p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

13188 WAPD-CP-950
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SUPPLEMENT TO SECOND FUEL MATERIAL TESTS IN X POSITIONS AT NRX REACTOR, AECL (WAPD-CP-870). Paul Cohen. Feb. 16, 1955. Decl. Mar. 7, 1957. 9p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

13189 WAPD-MRP-59
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD DECEMBER 2, 1955 TO JANUARY 12, 1956. Decl. Feb. 7, 1957. 98p. Contract AT-11-1-GEN-14. $0.60(OTS).

Progress is reported in engineering and development studies on pressurized water reactors. Plant parameters are summarized. Data are included from an analysis of power plants and systems; power plant components; an evaluation of materials, control mechanisms, and tests; design of the reactor and auxiliaries; fuel element development; metallurgical studies on core materials; in-pile loop studies; and reactor physics. (C.H.)

13190 WKNL-49
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
NUCLEAR POWER FOR PITTSBURGH; FINAL REPORT ON DUQUESNE–KIDDE NUCLEAR POWER STUDY.

James J. Barker. Nov. 10, 1955. Decl. May 8, 1957. 47p. $1.50(OTS).

Exploratory studies were conducted on sodium graphite and fast breeder reactors with reference to supplying electrical power to the Pittsburgh area. (L.T.W.)

NUCLEAR TRANSFORMATION

13191 MTA-48

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

EXCITATION FUNCTIONS FOR THE (d,2n) AND (d,4n) REACTIONS ON U^{238} AND Th^{232} FROM THRESHOLD TO 190 MEV. W. W. T. Crane and G. M. Iddings. Sept. 1953. Decl. Feb. 25, 1957. 12p. Contract AT(11-1)-74. $1.80(ph OTS); $1.80(mf OTS).

The absolute cross sections for the $U^{238}(d,2n)Np^{238}$, $U^{238}(d,4n)Np^{236}$, $Th^{232}(d,2n)Pa^{232}$, and $Th^{232}(d,4n)Pa^{230}$ reactions have been measured as a function of deuteron energy from the threshold to 190 Mev. Targets were irradiated on the Berkeley 60-inch and 184-inch cyclotrons. The cross sections rise sharply from threshold to a maximum value and then decrease monotonically to a small fraction of this maximum value at 190 Mev in general agreement with compound nucleus and nuclear transparency theory. (auth)

PARTICLE ACCELERATORS

13192 LRL-67

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

MARK I MTA LINEAR ACCELERATOR RUN NO. 1. R. J. Vetterlein. Nov. 1953. Decl. Apr. 5, 1957. 14p. Contract AT(11-1)-74. $3.30(ph OTS); $2.40(mf OTS).

The primary objective of the first run was to achieve successful integrated operation of all Mark I components but without injection and acceleration of any charged particles. Essentially, this meant evacuating the vessel and exciting the cavity to as high a r-f voltage as reasonably possible without overloading or damaging equipment. The voltage reached was 22.8 million volts peak end-to-end voltage, which is sufficiently high for proton acceleration. The run was stopped because damaging sparks occurred in the gap between No. 0 and No. 1 drift tubes. Other difficulties included leakage of the pre-exciter rotating loop seals, failure of the liquid N baffle automatic filling system, etc. During the shutdown it was planned to remove drift tubes No. 0 and 1 for cleaning and also to clean up the interior of the cavity in an effort to decrease sparking during the next run. (auth)

13193 LRL-92

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

MARK I MTA LINEAR ACCELERATOR RUN No. 9. R. J. Vetterlein. Mar. 1954. Decl. Apr. 5, 1957. 8p. Contract AT(11-1)-74. $1.80(ph OTS); $1.80(mf OTS).

Run No. 9 covers the period of Mark I operation from July 23 to August 5, 1953. It consisted of two attempts at operation, both of which were interrupted by sparking occasioned by the presence of foreign material on the drift tube surfaces. The second phase of operation was further hindered by water and vacuum leaks in the No. 2 drift tube. During the run a peak end-to-end voltage of 28 Mv was achieved with a 12% duty cycle and with the drift tubes spaced to provide a minimum gap of 12 in. No other significant results were obtained because the above difficulties finally forced a decision to shut down and make the necessary repairs. (auth)

13194 LWS-24589

California Research and Development Co., Livermore, Calif.

PRELIMINARY STUDY OF HELIUM COOLED, FLAT PLATE URANIUM PRIMARY TARGET. M. F. Katzer. Sept. 18, 1952. Decl. Apr. 5, 1957. 13p. (CRD-T2B-98). $3.30(ph OTS); $2.40(mf OTS).

The ultimate goal in the design of a primary target for Materials Testing Accelerator is to develop a target that can be adequately cooled, is economical to construct, and will meet the required production standards. A method for determining the conditions necessary to cool a radially cooled flat plate target with helium as the coolant has been developed. A method to tailor the plates to optimum sizes is shown. It may be necessary to use very thin plates (0.025 in.) at the end of the deuteron range to keep the heat flux to a minimum. A heat transfer coefficient of approximately 300 Btu/hr ft^2 °F is necessary to maintain reasonable flow rates. Even under these conditions, flow rates of 200 lbs/sec are required with plate spacings of 0.19 in. The feasibility of gas cooling uranium targets is shown, but it is believed that other metals such as Be, which has a lower heat generation per unit volume, may be more suited to gas cooling. (auth)

13195 LWS-24736(Del.)

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

FACILITIES FOR ELECTRONUCLEAR (MTA) PROGRAM. Feb. 1953. Decl. with deletions Feb. 26, 1957. 89p. Contract AT(11-1)-74. $15.30(ph OTS); $5.40(mf OTS).

The objective of the Electronuclear (MTA) Program is the development of a positive ion accelerator-target assembly which can be operated for the production of fissionable material from fertile material at a competitive cost. Design features are described of a proposed facility for the development of new linear accelerators and targets with the objective of evaluating on a realistic and practical basis the feasibility of industrial applications of the equipment. Detailed data are presented on design features and costs. (C.H.)

13196 NAA-SR-142(Del.)

North American Aviation, Inc., Downey, Calif.

TARGET ARRANGEMENT FOR THE PRODUCTION OF U^{233} WITH THE MTA MARK III. R. A. Laubenstein. Aug. 20, 1951. Decl. with deletions Mar. 4, 1957. 30p. Contract AT-11-1-GEN-8. $6.30(ph OTS); $3.00(mf OTS).

A primary, secondary, and tertiary target assembly is discussed for use in connection with the MTA Mark III cyclotron for the production of U^{233}. The thorium slab loaded tertiary target which was previously described briefly has been worked out in more detail with some modification in design based on recent theoretical calculations. Modifications in the design of the primary and secondary targets and in the methods of handling these elements have also been made. (auth)

13197 UCRL-2043(Del.)

California. Univ., Berkeley. Radiation Lab.

MTA QUARTERLY PROGRESS REPORT [FOR] JUNE, JULY, AUGUST, 1952. Dec. 8, 1952. Decl. with deletions Mar. 5, 1957. 148p. Contract W-7405-eng-48. $22.80 (ph OTS); $7.20(mf OTS).

Progress is reported on the following phases of the MTA program, Mark II cavity design; sparking characteristics of various electrode materials; the r-f regulator system for Mark I; Mark I mechanical design; Mark I target design; Mark II target and lattice physics program; Mark II target

theoretical and engineering physics; nuclear chemistry studies of Mark II target materials; and instrumentation and corrosion studies. (L.M.T.)

RADIATION ABSORPTION AND SCATTERING

13198 CF-51-6-84
[Oak Ridge National Lab., Tenn.]
EXPERIMENTAL VERIFICATION OF GAMMA SCATTERING CALCULATIONS. G. A. Allard. June 14, 1951. Decl. Feb. 20, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations are given which show that the water γ-scattering calculations presented in KAPL-504 are correct to within an order of magnitude when compared to the experimental results obtained at ORNL. The scheme followed to compensate for the difference in geometry is described in detail. (D.E.B.)

RADIATION EFFECTS

13199 ANL-5346
Argonne National Lab., Lemont, Ill.
EFFECT OF IRRADIATION UPON INTERDIFFUSION OF STAINLESS STEEL AND URANIUM. Final Report of Program 6.1.4. R. Weil and S. H. Paine. July 15, 1953. Decl. Feb. 13, 1957. 42p. Contract W-31-109-eng-38. $0.25(OTS).

Measurements of the interdiffusion in unirradiated and irradiated 347 stainless steel–uranium (normal and enriched) couples from 400 to 700°C for 1 to 16 days are reported. (J.A.G.)

13200 CP-1355
Chicago. Univ. Metallurgical Lab.
RADIOACTIVITY INDUCED IN COMMERCIAL MATERIALS. L. Seren, W. Sturm, W. Moyer, G. Miller, and W. Jordan. Feb. 12, 1944. Decl. Feb. 15, 1957. 9p. (A-2002). $1.80(ph OTS); $1.80(mf OTS).

Some structural metals (2S Al, 72S Al, Cu, Fe, steel, Pb, and Bi) were neutron irradiated, and the decay of the induced β and γ activities was followed. (L.T.W.)

13201 CRD-T2C-106
California Research and Development Co., Berkeley, Calif.
PRODUCTION OF U^{232} AND U^{230} FROM DEUTERONS ON A THORIUM TARGET. W. W. T. Crane and G. M. Iddings. Apr. 9, 1952. Decl. Feb. 16, 1957. 8p. (LWS-24333). $1.80(ph OTS); $1.80(mf OTS).

The excitation functions for the production of U^{232} and U^{230} by deuteron bombardment of thin Th targets are reported. The distribution and total amounts of U^{230} and U^{232} produced by deuterons on a Th primary target are calculated. (L.T.W.)

13202 CRD-T2C-108
California Research and Development Co., Berkeley, Calif.
PRODUCTION OF Pu^{238} AND Pu^{236} FROM DEUTERONS ON A URANIUM TARGET. W. W. T. Crane and G. M. Iddings. Apr. 11, 1952. Decl. Feb. 15, 1957. 8p. (LWS-24295). $1.80(ph OTS); $1.80(mf OTS).

The excitation functions for the production of Pu^{238} and Pu^{236} by deuteron bombardment of thin U targets were determined. The distribution and total amounts of Pu^{236} and Pu^{238} produced by deuterons on a U primary target are calculated. (L.T.W.)

13203 DC-51-11-18
Washington Univ., St. Louis. School of Engineering.
THE EFFECT OF CHARGED PARTICLES ON THE PHYSICO-MECHANICAL PROPERTIES OF MATERIALS. Monthly Report covering the period October 1, 1951 to November 1, 1951. W. P. Armstrong and C. J. Kippenhan. Decl. Feb. 22, 1957. 16p. For General Electric Co. Aircraft Gas Turbine Div. Subcontract No. 8. (GE-IY-6). $3.30(ph OTS); $2.40(mf OTS).

Deuteron bombardment experiments on stainless steel and Be_2C–graphite specimens were conducted. The effect was measured as change in electric resistivity and elastic modulus. (T.R.H.)

13204 DC-51-12-24
Washington Univ., St. Louis. School of Engineering.
THE EFFECT OF CHARGED PARTICLES ON THE PHYSICO-MECHANICAL PROPERTIES OF MATERIALS. Monthly Report Covering the Period November 1, 1951 to December 1, 1951. W. P. Armstrong and C. J. Kippenhan. Decl. Feb. 23, 1957. 16p. For General Electric Co. Aircraft Gas Turbine Div. Subcontract No. 8. (GE-IY-7). $3.30(ph OTS); $2.40(mf OTS).

Deuteron bombardments of 70% Be_2C–30% graphite, and spun silica cloth are described. (T.R.H.)

13205 HW-34820(Del.)
Hanford Atomic Products Operation, Richland, Wash.
EXAMINATION OF ZIRCONIUM EXPOSED TO 190 MWD/AT. W. S. Kelly. Feb. 11, 1955. Decl. with deletions Apr. 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The tensile properties, hardness, and grain structure of samples after an exposure of 190 Mwd/at were determined to study the effect of exposure time and the influence of prior mechanical cold work on changes occurring during irradiation. (F.S.)

13206 IDO-14348
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
RADIATION DAMAGE PROBLEMS IN THE ICPP BARIUM-140 SEPARATION PROCESS. R. L. Andelin. Nov. 1, 1955. Decl. Feb. 23, 1957. 72p. Contract AT(10-1)-205. $7.80(ph OTS); $3.30(mf OTS).

The feasibility of separating Ba^{140} from spent MTR fuel assemblies (activity 10^6 curies) by the modified RaLa Process was demonstrated. Radiation damage to process components and solutions was negligible. (C.W.H.)

13207 IDO-16364
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
REACTION PRODUCTS IN HIGH nvt IRRADIATED BERYLLIUM. John E. Evans. Sept. 13, 1956. 11p. Contract AT(10-1)-205. (PTR-119). $3.30(ph OTS); $2.40(mf OTS).

Estimates of the amounts of reactor poisons and other interesting reaction products expected to exist in Be that has been irradiated in the MTR (nvt of 2×10^{22} thermal neutrons/cm^2, 5×10^{21} fast neutrons/cm^2) are calculated. The values show that these products (except B^{10}) can be experimentally measured. (L.T.W.)

13208 NAA-SR-60(Del.)
North American Aviation, Inc., Los Angeles.
AN IMPROVED METHOD FOR DETERMINING ACTIVATION ENERGIES OF RELAXATION PROCESSES. G. J. Dienes and W. E. Parkins. Apr. 12, 1950. Decl. with deletions Feb. 27, 1957. 30p. Contract AT-11-1-gen-8. $4.80(ph OTS); $2.70(mf OTS).

A general procedure is described for determining the activation energy of an annealing process without using restrictive theoretical assumptions. The theory shows that activation energies are most reliably determined by analyzing experimental relaxation curves obtained at various constant annealing temperatures. The activation energy is directly calculable from the times and temperatures which

correspond to any arbitrary, but fixed, fractional anneal. The approximations involved in other techniques are briefly discussed. The theory is applicable to any physical property although written explicitly in terms of electrical resistivity. Experimental verification, based on electrical resistivity annealing of irradiated graphite, is presented. Comparison of two samples of different irradiation exposure shows that the most heavily damaged materials are characterized by higher activation energies for annealing carried out in identical temperature regions. The analytical method is applied to results of elastic modulus and electrical resistivity annealing measurements given in an earlier report. Anomalies in the early results are clarified. (auth)

13209 ORNL-1371
Oak Ridge National Lab., Tenn.
GAMMA RADIATION INDUCED IN ENGINEERING MATERIALS. C. D. Bopp. May 6, 1953. Decl. Mar. 2, 1957. 6ip. Contract W-7405-eng-26. $0.40(OTS).

The gamma activity induced in engineering materials in the X reactor was measured for long pile exposures and long decay periods. The decay curves were resolved into component activities which were tabulated so that the activity for any irradiation period may be calculated. The half thicknesses of Pb were determined from absorption measurements. (auth)

13210 TID-10033
Knolls Atomic Power Lab., Schenectady, N. Y.
THE THERMAL SPIKE PICTURE OF RADIATION DAMAGE. Harvey Brooks. Aug. 4, 1950. Decl. Mar. 12, 1957. 50p. $0.40(OTS).

The influence of fission products and neutron recoils on metals is discussed in terms of filamentary of spherical heated regions left in the wake of the fast particle, which spread according to the laws of heat conduction. It is shown that the electrons play a negligible role in the process and that only the part of the thermal conductivity which is due to the lattice should be used in the calculation of the energy spread. Rates of reaction induced by radiation are calculated on the assumption that the elementary processes occur according to a frequency law of the form: $\nu_n T^n e^{-\epsilon/kT}$ and that the effective frequency of such processes in the presence of radiation is obtained by averaging over the temperature distribution in the thermal spikes. Various refinements are considered, such as the influence of the variation of thermal conductivity with temperature. Rates of motion of phase boundaries and effective diffusion constants in the presence of radiation are also considered. (auth)

RADIOACTIVITY

13211 K-1095
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
ANALYSIS OF A POSSIBLE RADIATION BURST. L. Geller and H. F. Henry. June 2, 1953. Decl. Feb. 23, 1957. 27p. Contract W-7405-26. $4.80(ph OTS); $2.70(mf OTS).

Qualitative and quantitative aspects of an accidental critical reaction at the K-25 plant were calculated. Specific examples are considered to illustrate the effect of slight changes in geometry upon the results. (C.H.)

SHIELDING

13212 CF-49-8-81
Oak Ridge National Lab., Tenn.
REACTOR SHIELD ANALYSIS. Nicholas M. Smith, Jr. and David W. Whitcombe. Aug. 8, 1949. Decl. Feb. 21, 1957. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The mathematical models used in gamma and neutron shield design are presented and discussed. (D.E.B.)

13213 CF-53-9-16
Oak Ridge National Lab., Tenn.
MINIMUM SHIELD WEIGHT PENALTY FOR AIR DUCTS. E. P. Blizard. Sept. 2, 1953. Decl. Feb. 20, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Shielding-weight penalties for cooling-air voids within a spherical reactor and spherical shield are plotted against values of outer shield radii for a solid shield. Separate curves are given for several air-duct geometries. (D.E.B.)

13214 CF-54-7-14
Oak Ridge National Lab., Tenn.
EFFECTIVENESS OF LEAD GAMMA SHIELDING IN THE FUEL ELEMENTS OF THE TOWER SHIELDING REACTOR. C. E. Clifford, F. N. Watson, T. V. Blosser, L. B. Holland, and J. B. Dee. July 8, 1954. Decl. July 5, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

13215 HDC-2095
[Hanford Works,] Richland, Wash.
ANALOGUE STUDY OF HEAT TRANSFER IN A CONCRETE BIOLOGICAL SHIELD. L. E. Foster, L. H. McEwen, and C. E. Bonham. Apr. 24, 1951. Decl. Mar. 13, 1957. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

An analogue study is reported on temperature gradients through a concrete biological shield considering conduction of heat from the face near the thermal shield to the outside face, and of the heat generated in the shield due to neutron capture. (F.S.)

13216 KAPL-107
Knolls Atomic Power Lab., Schenectady, N. Y.
ENHANCEMENT OF LEAKAGE BY INTERNALS VOIDS IN A SHIELD. Lewi Tonks. Jan. 17, 1949. Decl. Mar. 18, 1957. 11p. Contract W-31-109-Eng-52. $0.25(OTS).

Voids and channels in a biological shield result in local areas of weaker shielding. Here a method of estimating this effect is developed, which is generally applicable to voids of many shapes. The significant way of expressing the result is by the excess attenuation over that which would be attained with a uniform shield having the minimum thickness found in the neighborhood of the void. (auth)

13217 KAPL-201
Knolls Atomic Power Lab., Schenectady, N. Y.
LEAKAGE OF NEUTRONS PAST A STEP IN AN ANNULUS. L. Tonks. June 20, 1949. Decl. Mar. 22, 1957. 10p. Contract W-31-109-Eng-52. $0.25(OTS).

The number of neutrons which escape from an annulus relative to the number of faster neutrons which strike a small step at some depth in it has been calculated. The principal result is given. It is useful in the design of experimental holes. A small modification makes the calculation applicable to rectangular plugs in rectangular holes. (auth)

13218 KAPL-704
Knolls Atomic Power Lab., Schenectady, N. Y.
NEUTRON SHIELDING MATERIALS. T. M. Snyder. Feb. 12, 1952. Decl. Mar. 28, 1957. 8p. Contract W-31-109-Eng-52. $0.20(OTS).

Odd Z elements proved to be better than even Z elements for neutron shielding. The nuclear properties of V, Mn, Co, Cu, As, Br, Ag, Sb, and I were studied. From this study, Cu appears to be the best of the odd Z elements in every regard. It was concluded that Cu should receive

serious attention as a possible shielding material wherever compactness and low shield weight are at a premium. (C.H.)

13219 ORNL-209

Oak Ridge National Lab., Tenn.

REACTOR SHIELDING WITH AN IRON AGGREGATE CONCRETE—COMPARISON WITH ORDINARY CONCRETE. E. P. Blizard. Mar. 16, 1949. Decl. Mar. 19, 1957. 39p. Contract W-7405-eng-26. $0.35(OTS).

Results are given of the first attempts to make a monolithic shield, equivalent to the laminated Hanford structure, using iron aggregate concretes with approximately the same ratio of iron to hydrogen as in the Hanford prototype. Data are tabulated and graphed. (M.H.R.)

13220 TID-10091

North American Aviation, Inc., Downey, Calif.

SHIELDING REQUIREMENTS FOR NAA NPR RECYCLED COOLING WATER SYSTEM. M. H. Feldman and R. L. Loftness. Dec. 8, 1950. Decl. Mar. 18, 1957. 33p. Contract AT-11-1-GEN-8. $0.30(OTS).

Shielding requirements, for an NPR cooling system utilizing recycled water, are analyzed on the basis of initial water purity, corrosion rate, water transit-time through the reactor, hold-up time outside the reactor and water-system geometry. For the reactor designs proposed in NAA-SR-61 and NAA-SR-90, with water containing 8 ppm of Na, it is estimated that adequate biological shielding is furnished by a 48-inch layer of concrete (density = 6000 lbs/yd^3) surrounding the water mains between the reactor exit and the heat exchanger. The radiospecies giving rise to the water activity in this region are N^{16}, Al^{28}, and Na^{24}. Practically no shielding is required at any other portion of the external water circuit. These results are found to be in agreement with values estimated from the shielding proposed for the MTR cooling system. (auth)

URANIUM AND URANIUM COMPOUNDS

13221 CT-2002

Battelle Memorial Inst., Columbus, Ohio.

METALLURGY OF TUBALLOY [URANIUM]. Progress Report. Aug. 1, 1944. Decl. Feb. 19, 1957. 23p. (A-2885). $4.80(ph OTS); $2.70(mf OTS).

The mean coefficients of expansion of U in the three crystallographic directions were calculated for the range 25 to 300°C from X-ray diffraction data. The tentative values are: $\alpha_a = 24 \times 10^{-6}$ per °C, $\alpha_b = -3 \times 10^{-6}$ per °C, and $\alpha_c = 18 \times 10^{-6}$ per °C. These coefficients are consistent with the dilatometer data on polycrystalline material and provide an explanation for the wide range of expansion coefficients that have been observed in the dilatometer work. A more detailed investigation of the operation of the phosphoric acid pretreatment bath has shown that the optimum operating conditions are a temperature of about 104°F (40°C) and a current density of 0.5 amp./sq. in. Studies of the stripping step following the anodic treatment showed that 50 to 70% HNO_3 gave the best results, with the more concentrated acid showing most promise because of its long life. Various treatments preceding and following stripping did not show any improvement over the standard method. Adherent deposits of Fe, Ni, and Cu have been obtained. Annealing studies on hot-rolled strip show grain growth occurring at 600°C. Cold-rolled strip shows recrystallization at 500 to 600°C, depending on time. Fine grains can be produced by heating into beta for a short time and air cooling, longer heating time producing larger grains. Slight grain growth occurs in alpha-rolled and extruded metal in six hours at 600 and 655°C, but biscuit metal, gamma-extruded and gamma-extruded-outgassed metals show no significant changes in structure. However, all five types of metal give the same microstructure when heated to beta and quenched. Further tests on alpha extrusion suggest that the failure of billets to extrude when heated into beta and cooled back may relate to surface condition of the billets. Examination of three sections of large bars extruded indicates greater freedom from internal unsoundness and suggests approaching this practice for improvement in the quality of gamma extrusions. (auth)

13222 NYO-5224

Mallinckrodt Chemical Works, St. Louis.

THE OXIDATION OF UO_2 IN AIR AND UNDER CONDITIONS OF STORAGE. J. Stevenson and J. Boyd. Apr. 1, 1948. Decl. Mar. 7, 1957. 27p. $0.35(OTS).

Varying oxidation losses of up to 2 to 3% UO_2 was observed during storage of UO_2 but they have been considered abnormal, probably the product of unusual variations in storage conditions. Since long term storage of UO_2 has been proposed it is essential to know the rate and extent of oxidation of UO_2 under current storage conditions. Some knowledge of the oxidation mechanism would be desirable. To obtain this knowledge, a study of the variables affecting the rate and extent of oxidation of UO_2 was conducted. Under current storage conditions oxidation losses reach at least 1% UO_2 in about two months. Further losses probably depend on the rate of diffusion of air into the container and occur relatively slowly. Under optimum storage and handling conditions no more than 0.4% UO_2 loss would be incurred. These conditions require transfer of the UO_2 to an air tight container within two hours after exposure to air and at a temperature of 25°C or less. The initial rate of oxidation of UO_2 is probably determined by the rate of the chemical reaction. This rate diminishes rapidly to a constant value suggesting that gas diffusion or solid rearrangement may be controlling the rate of oxidation. The rate and extent of oxidation of UO_2 are functions of: surface of UO_2, temperature, time, concentration of oxygen in the oxidizing atmosphere, and history of the UO_2. (J.E.D.)

13223 WAPD-TN-506

Westinghouse Electric Corp., Atomic Power Div., Pittsburgh.

GROWTH OF CONSTRAINED ALPHA ROLLED URANIUM UNDER IRRADIATION. J. D. Eichenberg. Nov. 19, 1954. Decl. Mar. 11, 1957. 22p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

An attempt was made to determine the force required to restrain the growth of alpha-rolled U under irradiation. Crystal bar Zr capsules of varying wall thicknesses were used to supply the restraining force. Unfortunately, the force exerted by the capsules was insufficient to restrain the growth of the U and all of the capsules fractured. Therefore, it was possible to calculate only the force which must be exceeded if alpha rolled U is to be restrained from growing under irradiation. This force is between 8000 psi and 9300 psi when the average temperature of the U is between 70°C (158°F) and 140°C (284°F). (auth)